CanoScan FS 4000 US

SERVICE MANUAL

REVISION 0

Canon

DEC. 2001 JY8-1320-00Z

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I FEATURES

CanoScan FS4000US is a desktop film scanner for commercial market, which has been developed next to CanoScan 2700F and FS2710.

This scanner features as follows.

1. 4,000 dpi, the highest resolution in this class of products.
2. 14-bit A/D that has realized a high tone reproduction.
3. Equipped with two interfaces; USB for simple connection with a personal computer and SCSI for high-speed data transmission.
4. Dust/scratch correction function FARE is incorporated to automatically recognize dust and scratch on film surface and make correction for them so as to obtain a clear image.
5. Scanning application FilmGetFS (for Windows/Macintosh) which provides a variety of functions.
6. IX-240 film cartridge holder permits a continuous IX-240 film scan of up to 40 frames.
7. In combination with a special film holder, this scanner can continuously scan max. 4 frames of slide mount and max. 6 frames of 35 mm film strip.
8. Auto focus function is adopted.
9. Light source uses a cold-cathode mercury fluorescent lamp that has a high brightness and excels in film color reproduction.
10. An ultramodern and well-organized form using a number of curves.

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II SPECIFICATIONS

Main Frame

• Type	: Desktop film scanner

Reading Block

• Image sensor	: 5300-pixel, 3-line CCD
• Light source	: Cold-cathode mercury fluorescent lamp (for usual scan : visible light)
	LED (for dust/scratch correction function : infrared light)
• Kind of film	: 35mm film, negative/positive
	(6-frame sheet type, slide mount type)
	: IX-240 film, negative/positive
• Maximum readable size	: 35mm film (24.0 mm x 36.0 mm)
	: IX-240 film (16.5 mm x 30.0 mm)
• Image signal output	: Color 42 bits (14 bits for each of R, G and B ; 16,384 gradations)
	Color 24 bits (8 bits for each of R, G and B ; 256 gradations)
	Monochrome 8 bits (256 gradations)
	Monochrome 14 bits (16,384 gradations)
	Monochrome binary in 1 bit
• Optical resolution	: 160/500/1000/2000/4000 dpi
• Reading speed	: Maximum 8 msec/line (on both 35mm and IX-240 films)
• Thumbnail scan speed	
35mm film	: Slide mount 4 frames : 6 sec, sheet 6 frames : 6 sec
IX-240 film	: Positive 25 frames : about 10 sec, negative 25 frames : about 30 sec
• Image inversion	: Negative/positive inversion
• Mirror image	: Image inverted in the horizontal scanning direction
• Reading area specification	: Only one rectangular area is specified

Interface Block

• Interface	: SCSI II (half-pitch pin type, 50 pins in 2 lines)
	: USB 1.1

These interfaces are selectable by a switch in the bottom of main frame.

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Others

• Ambient conditions	:	Temperature 10 to 35ºC Humidity 10 to 90% (85% only in IX-240 film feed) Atmospheric pressure 613 to 1013 hPa
• Power supply	:	100 to 240 V, 50/60 Hz (automatic changeover)
• Power consumption	:	35 W or less (under operation), 12 W or less (in standby status)
• Dimensions	:	Width•••92mm Depth•••368mm Height•••144mm
• Weight	:	About 2.4 kg
• Option	:	Not provided

Descriptions are subject to change for further product improvement.

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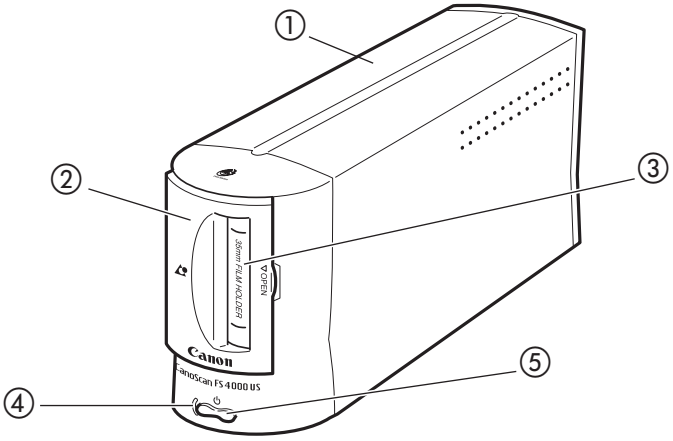
III NAME OF EACH PART

A. Front view



① Top cover

② Front panel

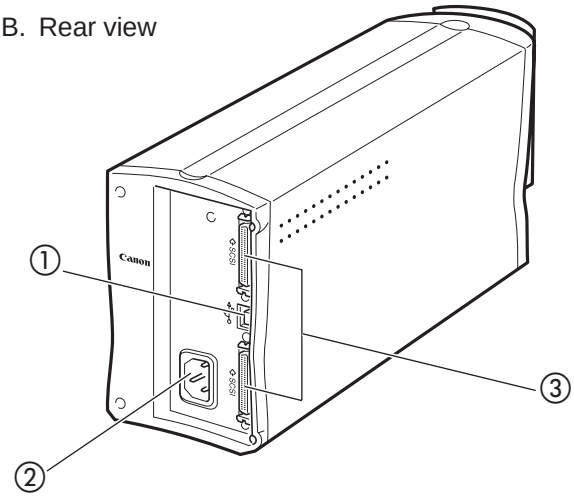
③ Film holder inlet (with dust cover)

④ Pilot lamp

⑤ Power switch

Fig. 1-1

B. Rear view



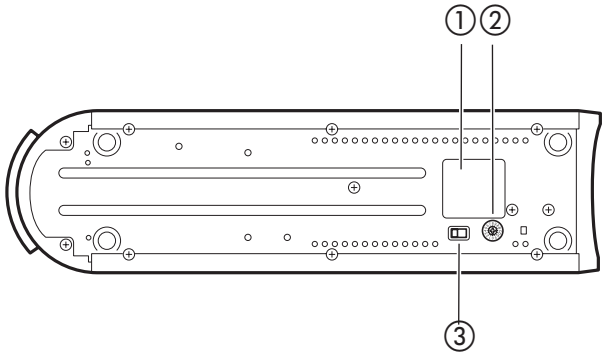
① USB connector

② Power connector

③ SCSI connector

Fig. 1-2

C. Bottom view



① SCSI setting label

② SCSI dial

③ Interface selector switch

Fig. 1-3

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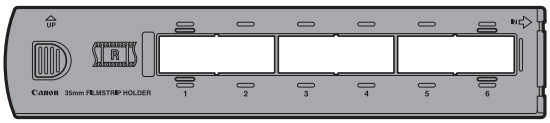
D. Film holder

Film strip holder



Slide mount holder

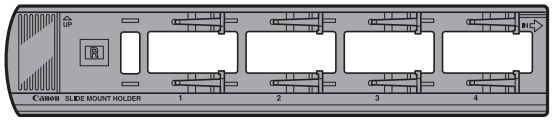
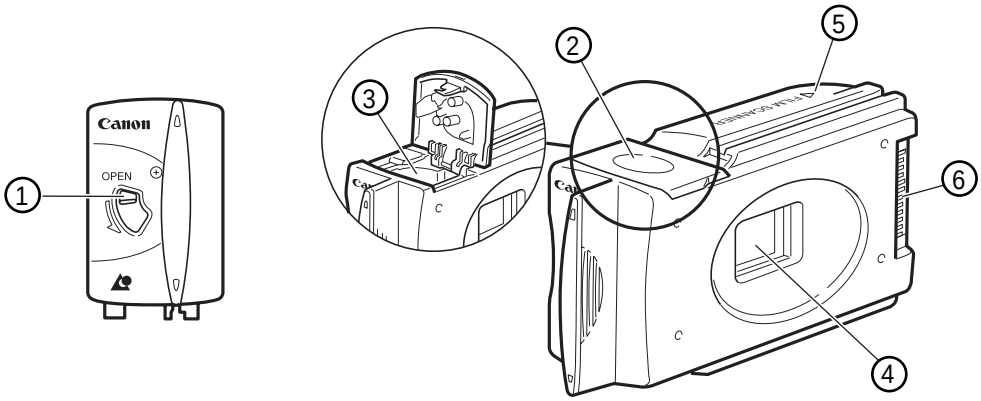


Fig. 1-4

E. APS adapter (IX-240 Film Cartridge Holder)



① Open/close lever

② Cartridge compartment lid

③ Cartridge compartment

④ Film reading window

⑤ Inserting

⑥ Electric contacts

Fig. 1-5

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IV OPERATION

A. SCSI connection

1. Setting of SCSI ID and terminator

Before using the scanner, SCSI ID must be set by SCSI ID selector.

1) Remove the switch block cover and turn the interface selector switch to the SCSI side.

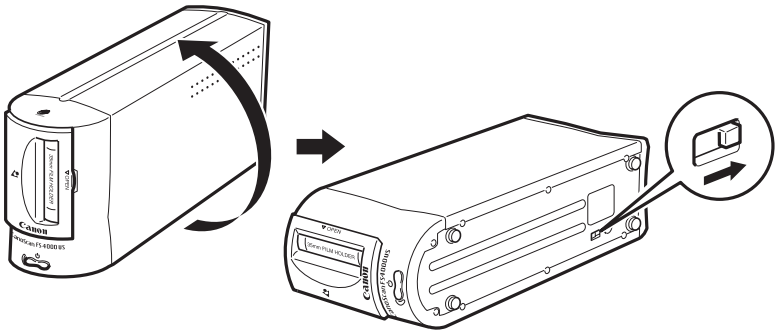
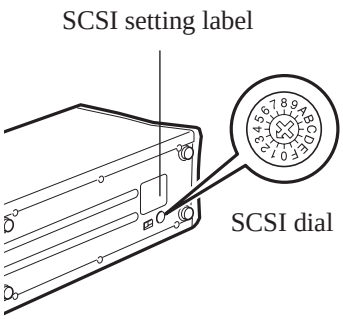


Fig. 1-6

2) For connecting the scanner to the end of daisy chain, select a number unused by other equipment on the TERMINATOR ON side.



SCSI ID		0	1	2	3	4	5	6	7
TERMINATOR	ON	0	1	2	3	4	5	6	7
	OFF	8	9	A	B	C	D	E	F

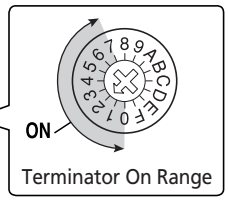


Fig. 1-7

3) For connecting the scanner to the mid-point of daisy chain, select a number unused by other equipment on the TERMINATOR OFF side.

SCSI ID		0	1	2	3	4	5	6	7
TERMINATOR	ON	0	1	2	3	4	5	6	7
	OFF	8	9	A	B	C	D	E	F

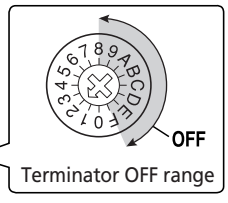


Fig. 1-8

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2. Connection with a computer

When mounting an SCSI board to a computer, refer to the manual of each equipment. SCSI cable should be a commercially available one.

Before connection, make sure each power supply of the scanner and computer is turned off.

1) Connect the SCSI cable to the SCSI terminal of the computer.

   A commercially available conversion adapter is required if direct connection is impossible due to pin/terminal shape.

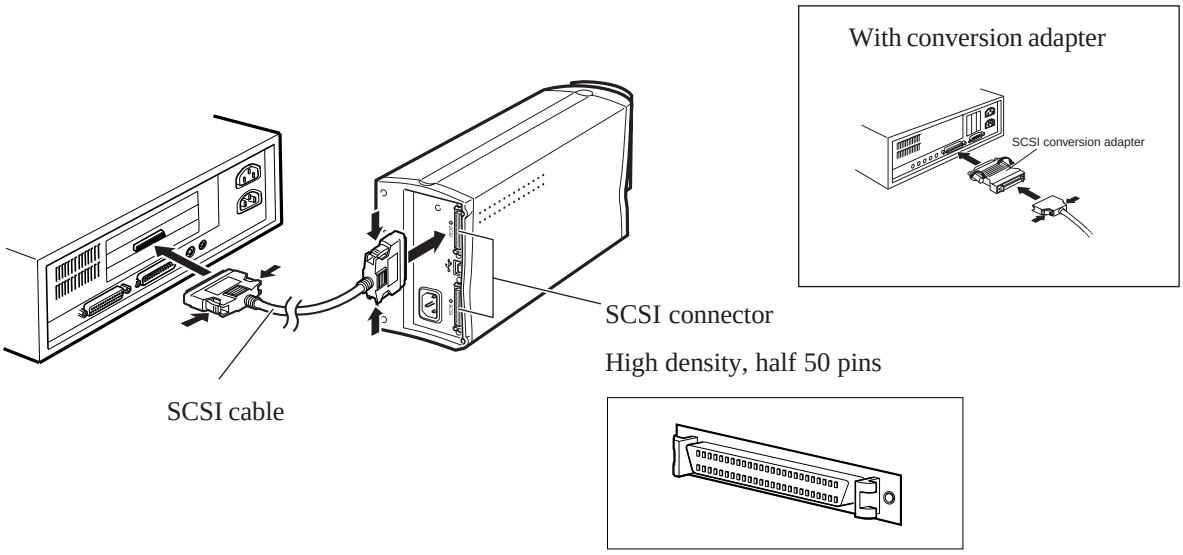
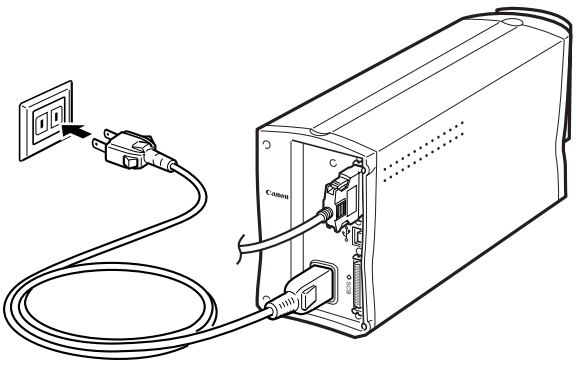


Fig. 1-9

2) Connect the power cable to the scanner.



Power cable

Fig. 1-10

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B. USB connection

1. Setting of interface selector switch

Remove the switch block cover and turn the interface selector switch to the USB side.

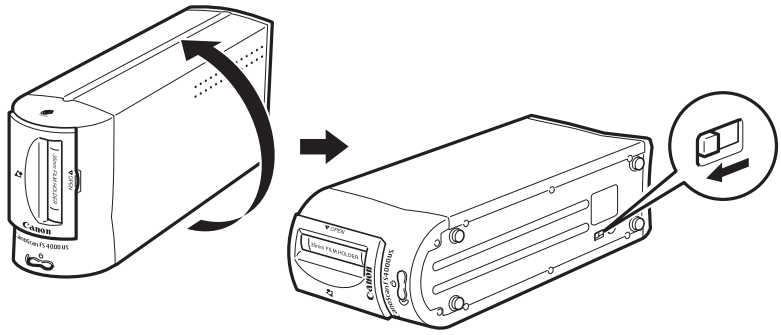
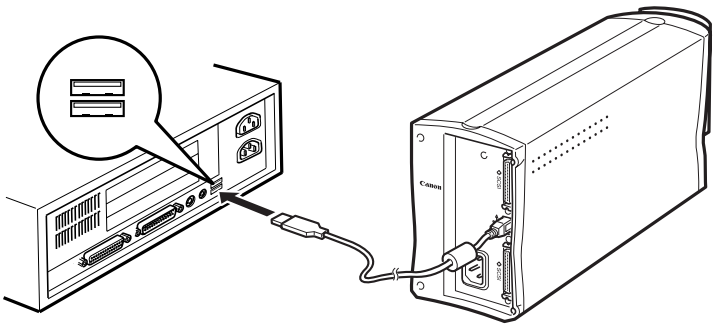


Fig. 1-11

2. Connection of USB cable

Connect the scanner and computer using the supplied USB cable.

For connection, computer power may be turned on or off.



Shape of USB connector

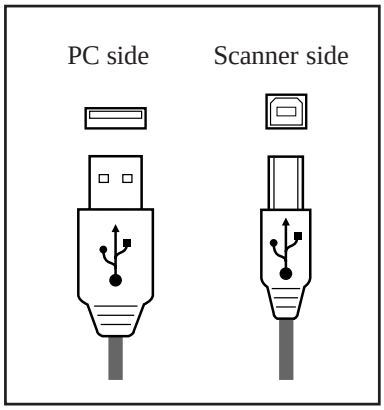


Fig. 1-12

3. Connection of power cable

Connect the power cable to the scanner.

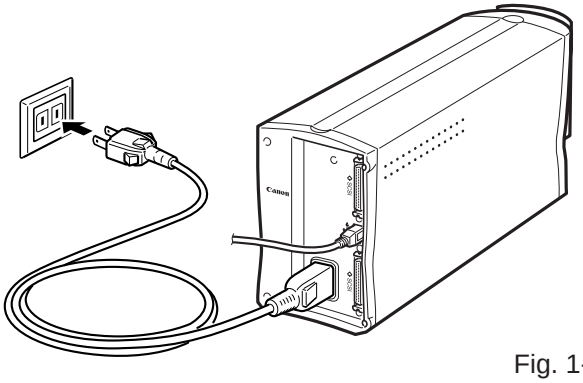


Fig. 1-13

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C. Setting of film

1. Setting of 6-frame sheet

1) Open the 35 mm FILMSTRIP HOLDER.

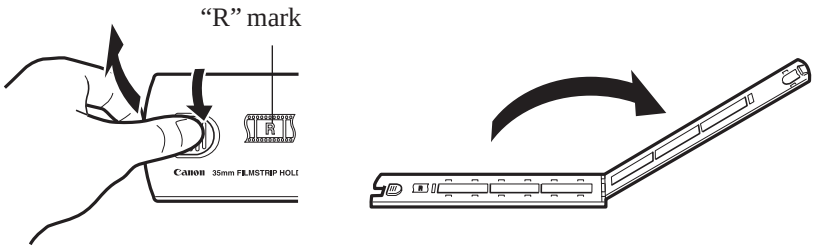

Fig. 1-14

2) Set a 35 mm film with its front face upward.

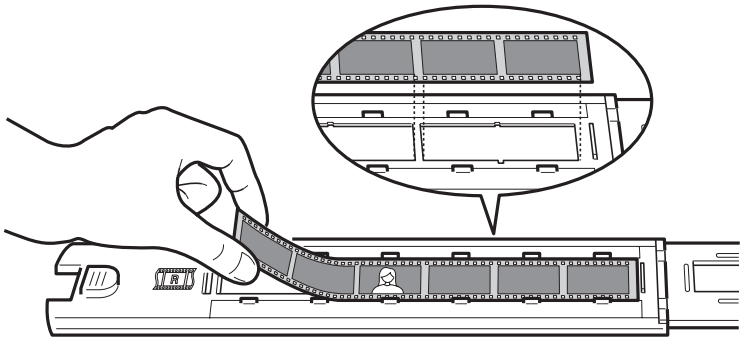

Fig. 1-15

3) Close the 35 mm FILMSTRIP HOLDER.

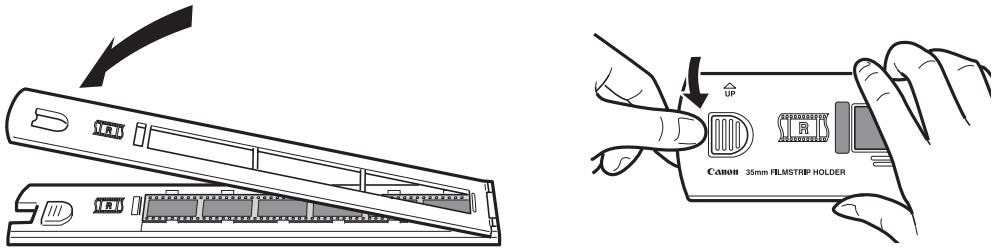

Fig. 1-16

4) Insert the 35 mm FILMSTRIP HOLDER into the scanner.

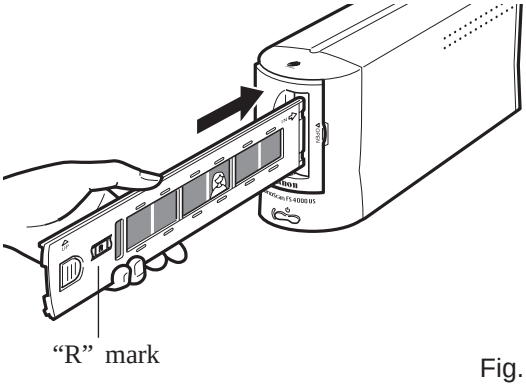

Fig. 1-17

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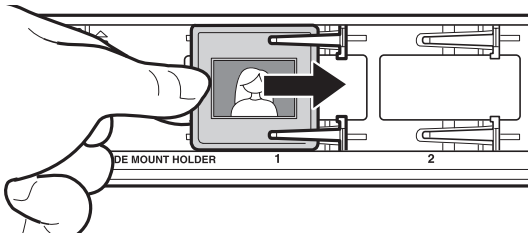
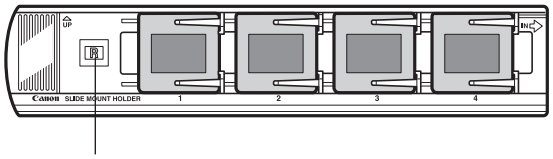
2. Setting of slide mount film

1) Set a slide to SLIDE MOUNT HOLDER with its front face upward.



4 slides set on the holder

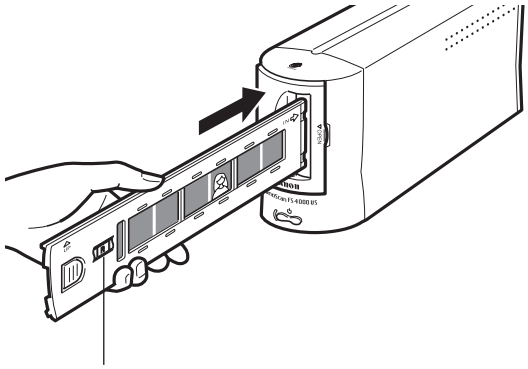


"R" mark

Fig. 1-18

2) Insert the SLIDE MOUNT HOLDER to the scanner.

(The figure shown below corresponds to the 35 mm FILMSTRIP HOLDER.)



"R" mark

Fig. 1-19

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3. Setting of IX-240 film

1) Open the lid by lowering the open/close lever of IX-240 Film Cartridge Holder as directed by the arrow.

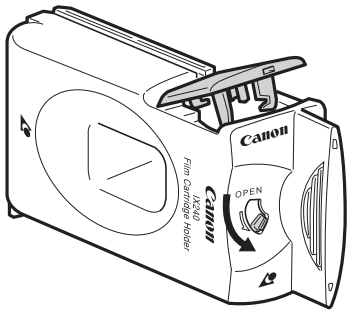

Fig. 1-20

2) Insert an IX-240 film facing the exposure mark upward and close the lid.

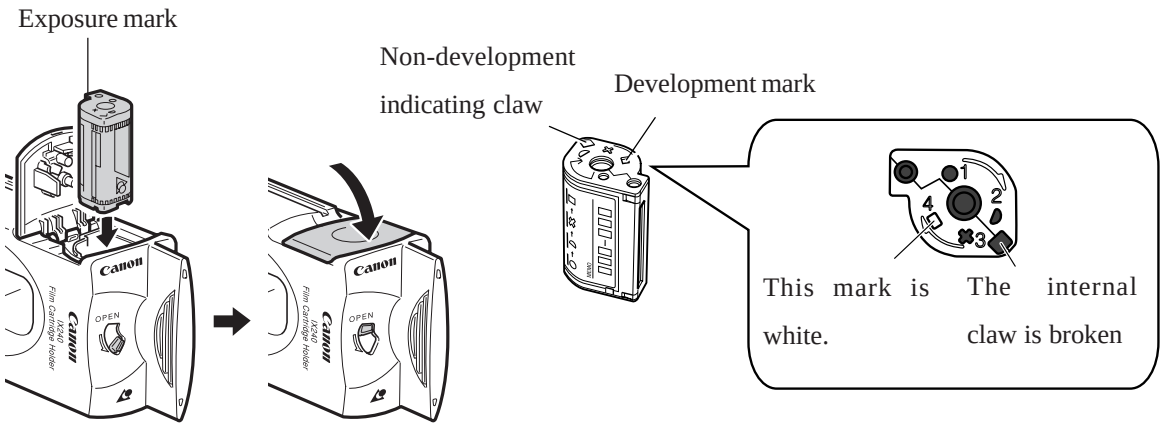

Fig. 1-21

3) Open the front panel of the scanner and insert the IX-240 Film Cartridge Holder according to the inserting direction mark until it stops.

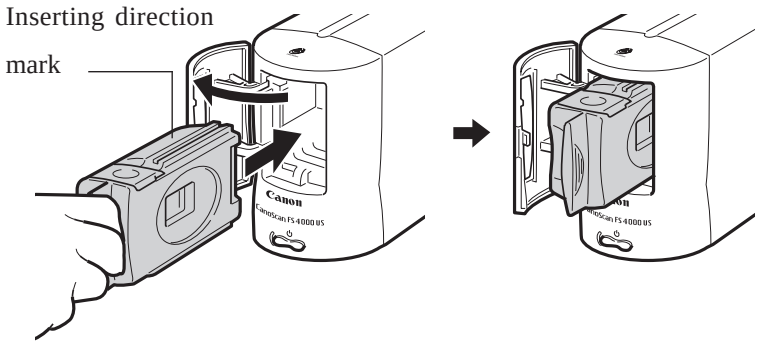

Fig. 1-22

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CHAPTER 2

OUTLINE OF OPERATION

1. This chapter overviews the purpose and role of each function, the relationship between the electric and mechanical systems and the operation timing of each section in blocks of function. Symbol ▬▬ in the schematic diagram represents a transmission of mechanical drive. And symbol ⟶ indicates a flow of a single electric signal when it is marked together with a signal name, and symbol ⟹ indicates a flow of multiple signals.
2. An electric signal level is indicated by "H" or a signal name without an over-line such as BUSY, or by "L" or a signal name with it such as $\overline{\text{LON}}$.
   The "H" or a signal name without an over-line is valid (indicating that the relevant signal is output) when the line voltage level is reached, and invalid (indicating that the relevant signal is not output) when the voltage has fallen to the GND level.
   The "L" or a signal name with an over-line is valid at the GND level and invalid at the line voltage level.

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I BASIC OPERATION

A. Functional configuration

This scanner is composed of 3 blocks listed below.

1) Optical block

This block provides the functions for illuminating a film with a film illumination lamp and for focusing the light transmitted through the film onto the CCD face by a mirror and lens.

2) Image processing block

This block converts an image formed on the CCD face into an electric signal and performs various image processings.

3) Control block

This block provides an interface with external equipment and controls the entire film scanner.

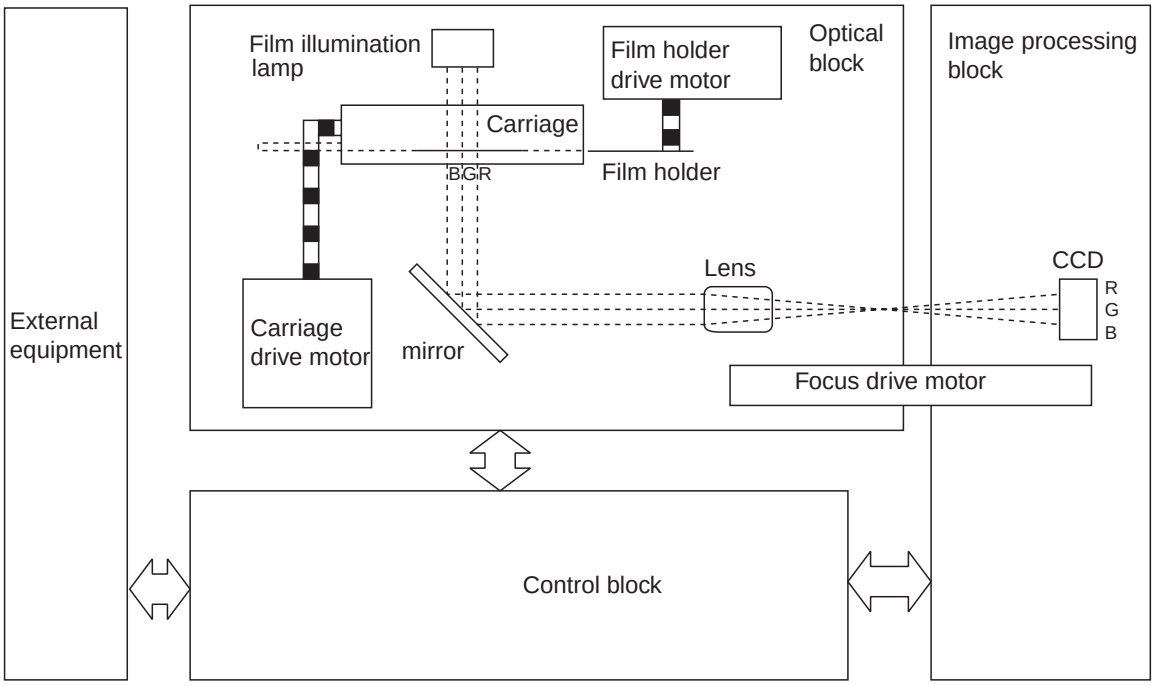

Fig. 2-1

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B. Outline of electric circuit

The main electric control of this scanner depends on the CPU circuit board.

An image signal read by CCD is converted into digital data by analog IC. The converted digital data is subjected to various image processings by ASIC and output to a PC from SCSI terminal through SCSI control IC or from USB terminal through USB control IC.

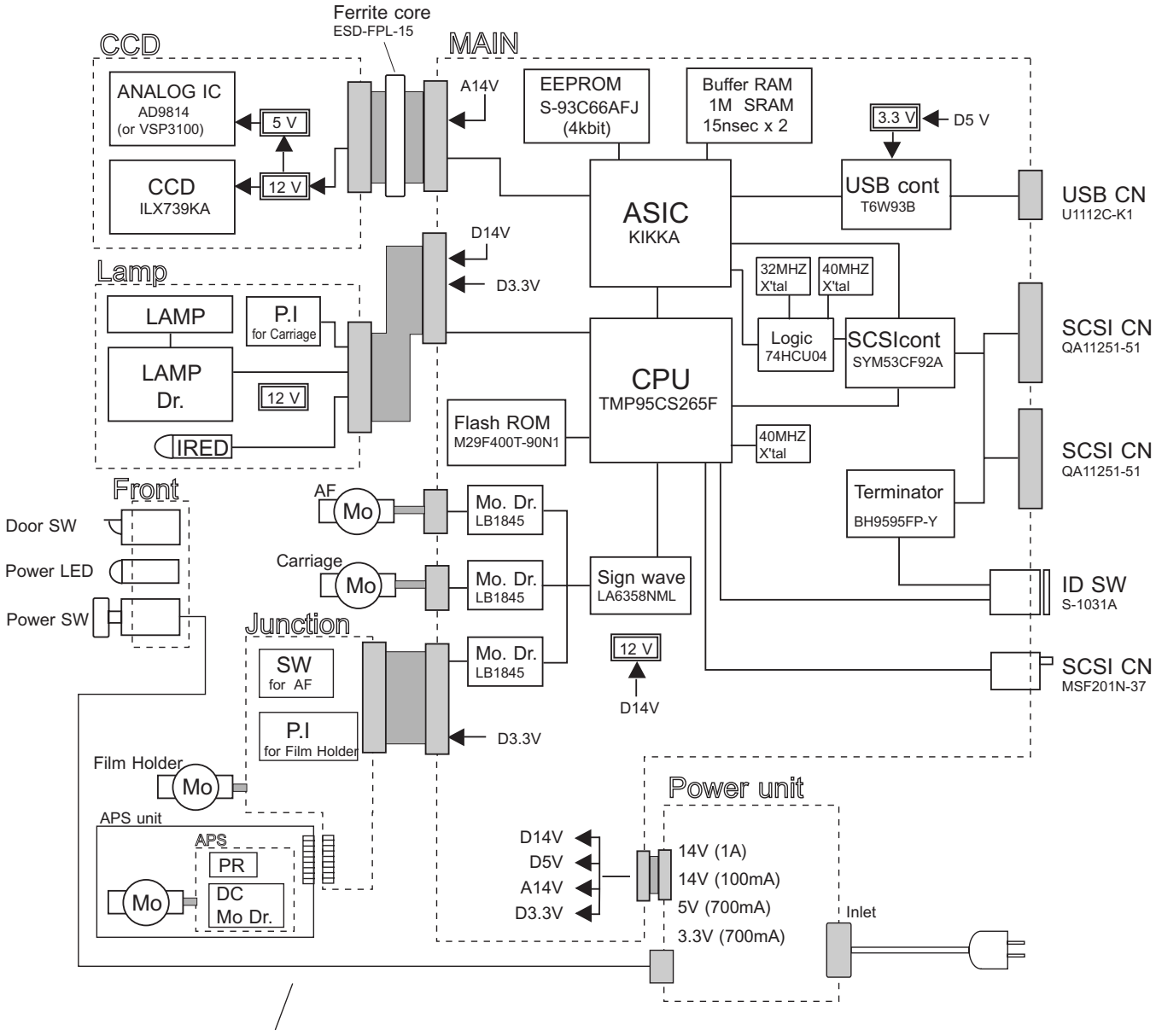

Fig. 2-2

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1. Functions of circuit board elements

a. Flash ROM

Stores a program (firmware) which controls a series of internal scanner operations.

b. EEP-ROM

Stores the following information.

- Characteristic data of CCD
- Condition for lighting the film illumination lamp
- Various characteristics of analog circuit
- Positional error information about mechanical system

c. Analog IC

Converts image signals (analog signals) read by CCD into digital data.

d. Gate array

Performs various processings listed below.

- Generation of clock for image processing/CCD
- Lamp light control
- Black shading correction
- White shading correction
- AGC (Auto Gain Control)
- Control of offset RAM
- Control of line buffer
- SCSI control
- USB control
- Image processing (binary coding, automatic base color correction, gamma correction, etc.)

e. Offset RAM

Stores image data at the time of color synthesis. Also used as a working memory of CPU.

f. Shading RAM

Stores black and white shading data.

g. Line buffer

Temporarily stores image data for its transmission to external equipment.

h. SCSI control IC

A controller for SCSI communication. It controls data transmission to external equipment.

i. USB control IC

A controller for USB communication. It controls data transmission to external equipment.

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C. CPU circuit board input and output

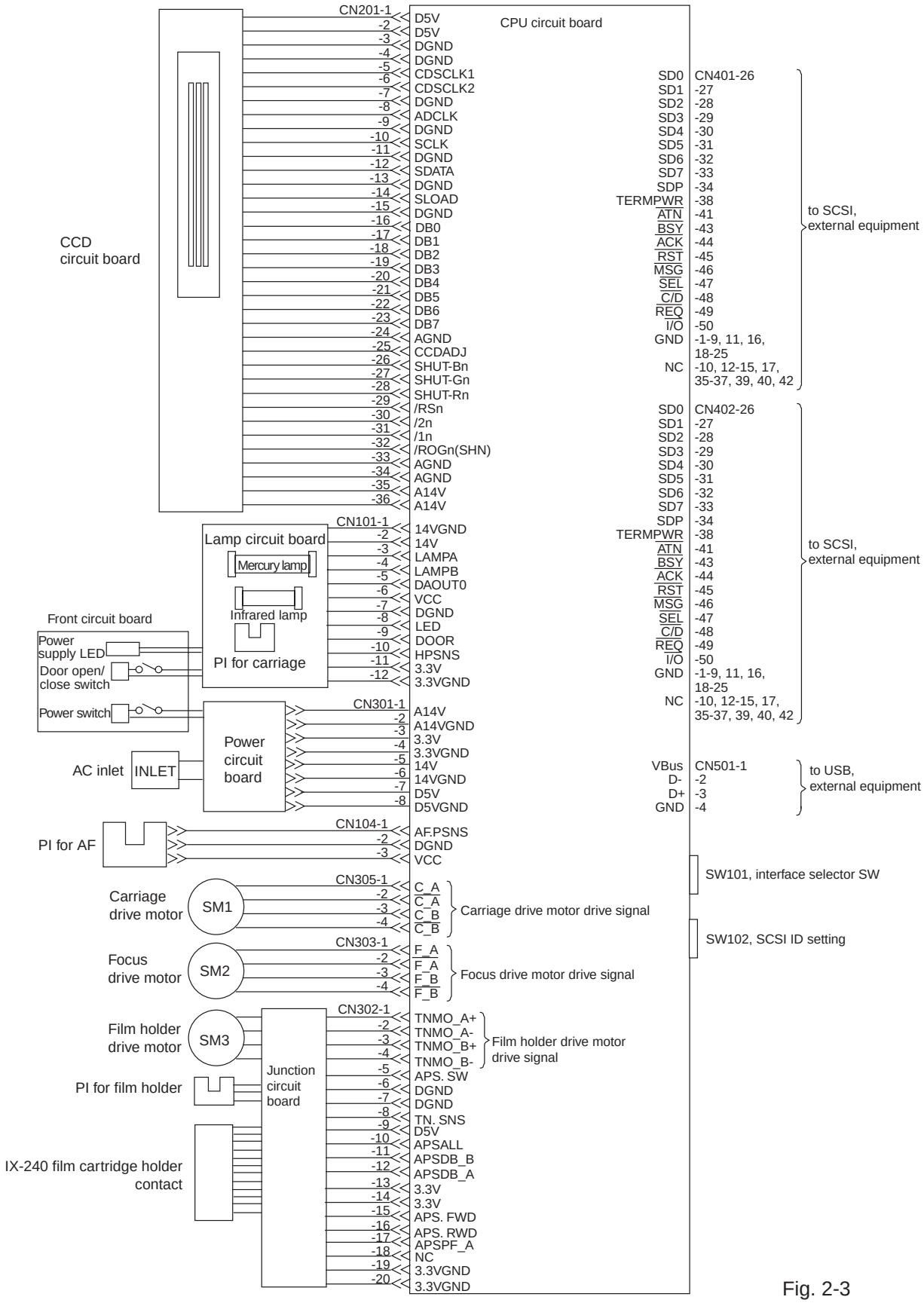

Fig. 2-3

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D. Basic sequence

This scanner primarily has two sequences; power ON sequence and film scanning sequence.

1. Power ON sequence (initial operation flow of main frame firmware)

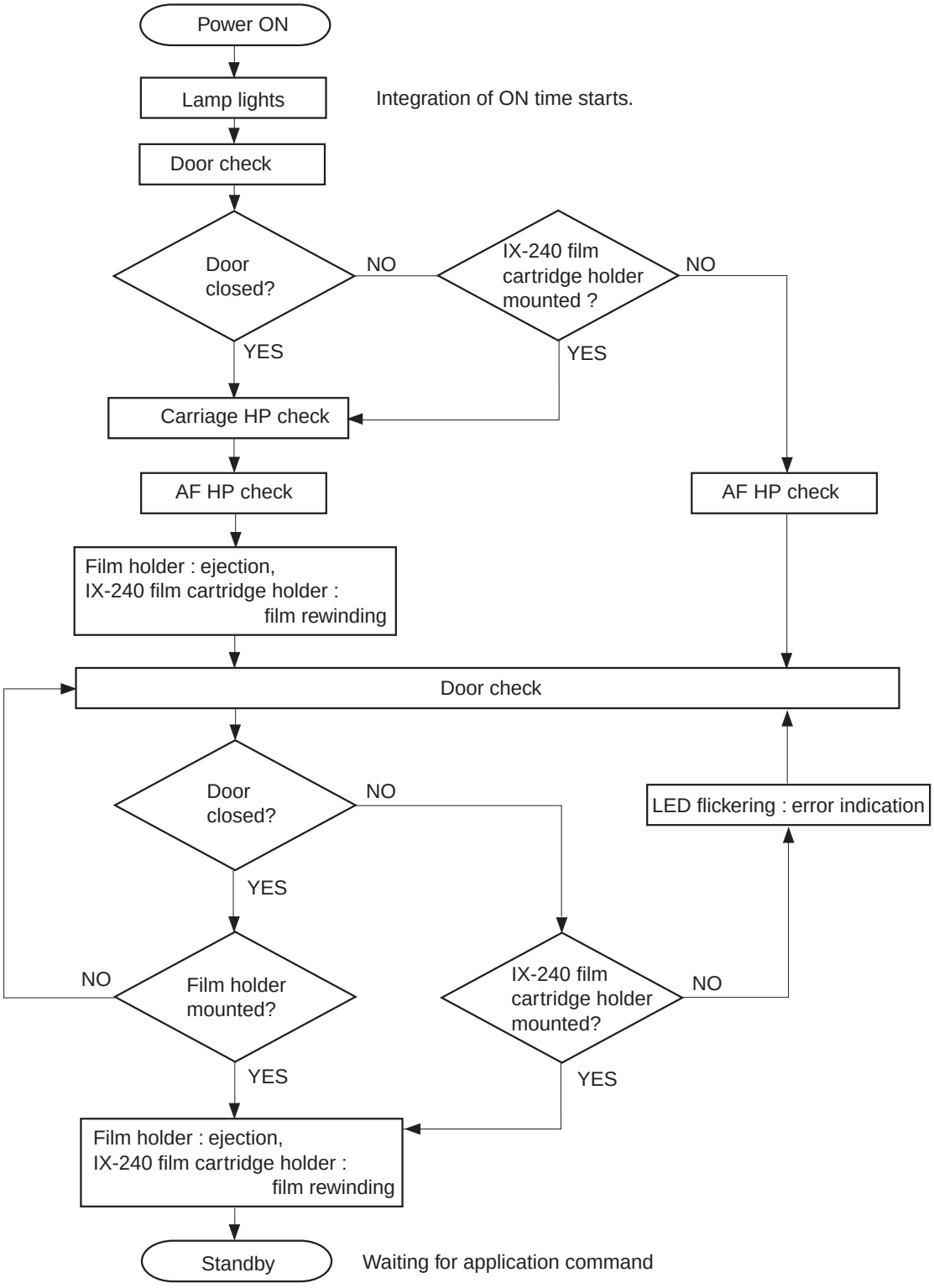

Fig. 2-4-1

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2. Light quantity check sequence

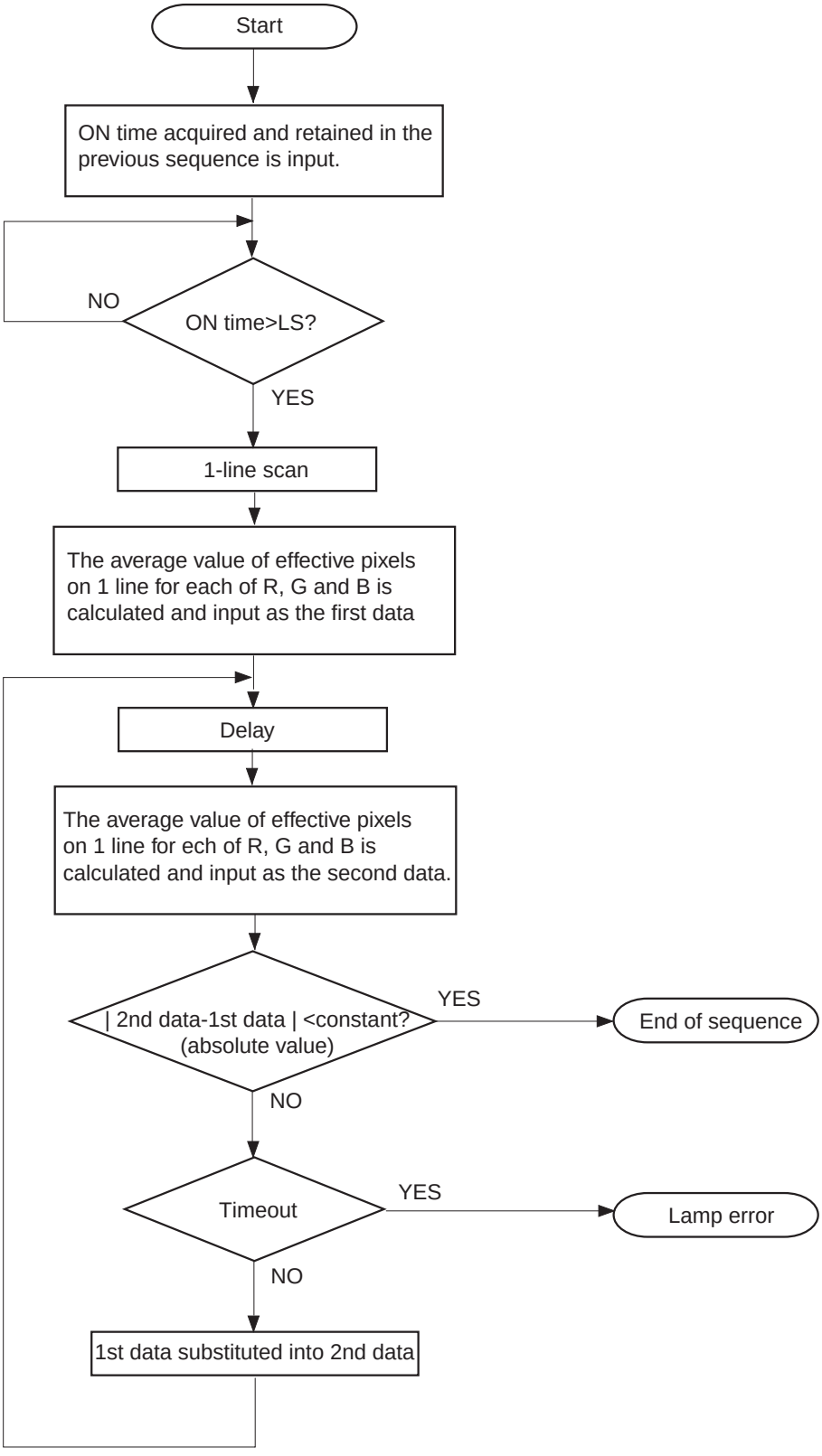
Start
ON time acquired and retained in the previous sequence is input.
NO
ON time>LS?
YES
1-line scan
The average value of effective pixels on 1 line for each of R, G and B is calculated and input as the first data
Delay
The average value of effective pixels on 1 line for ech of R, G and B is calculated and input as the second data.
| 2nd data-1st data | <constant? (absolute value)
YES
End of sequence
NO
Timeout
YES
Lamp error
NO
1st data substituted into 2nd data

Fig. 2-4-2

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3. Shading judgment sequence

Shading judgment is to be made separately between 35mm and IX-240 films.

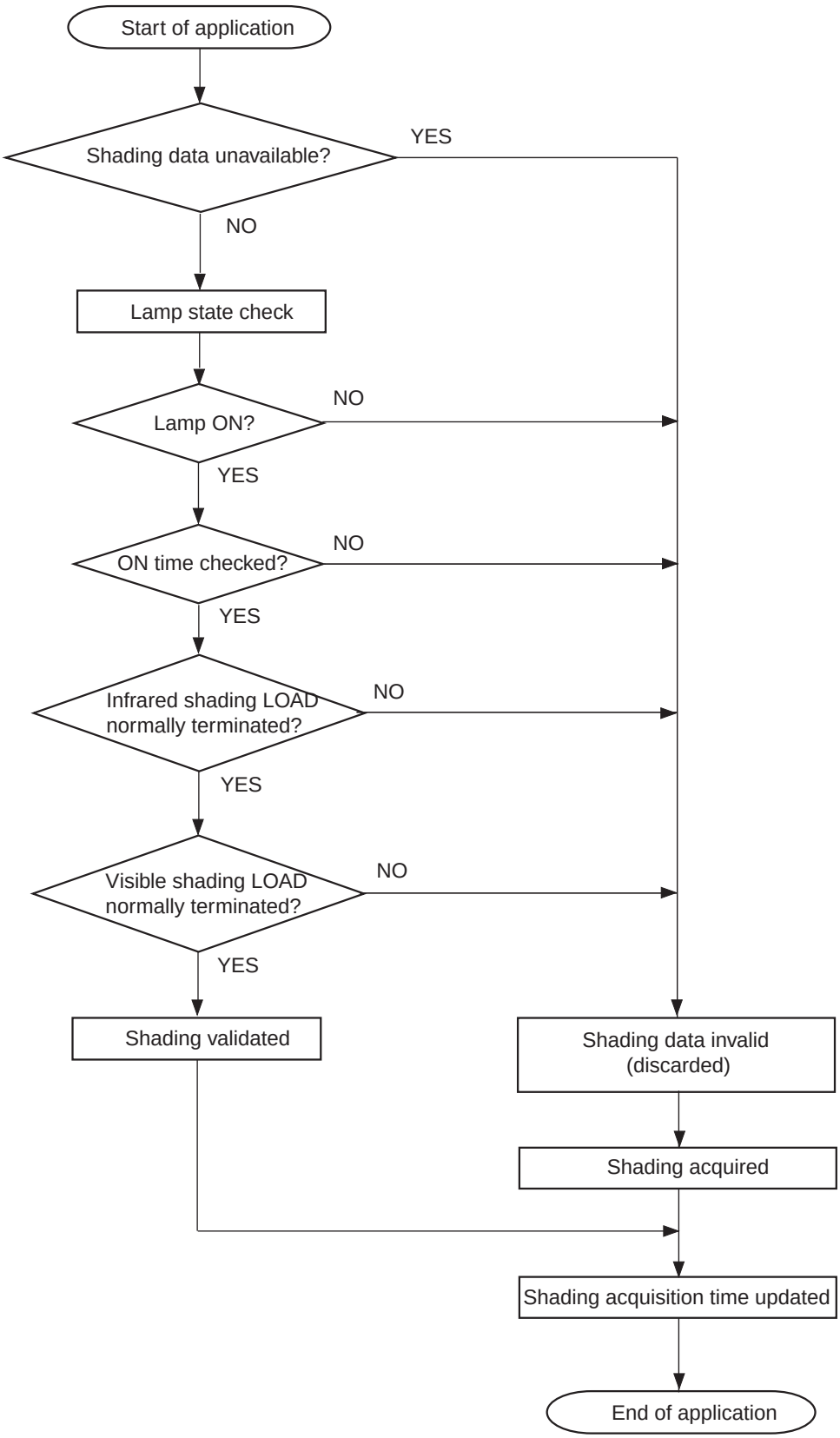

Fig. 2-4-3

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4. Processing at the start of application and insertion of holder (IX-240 film - 1)

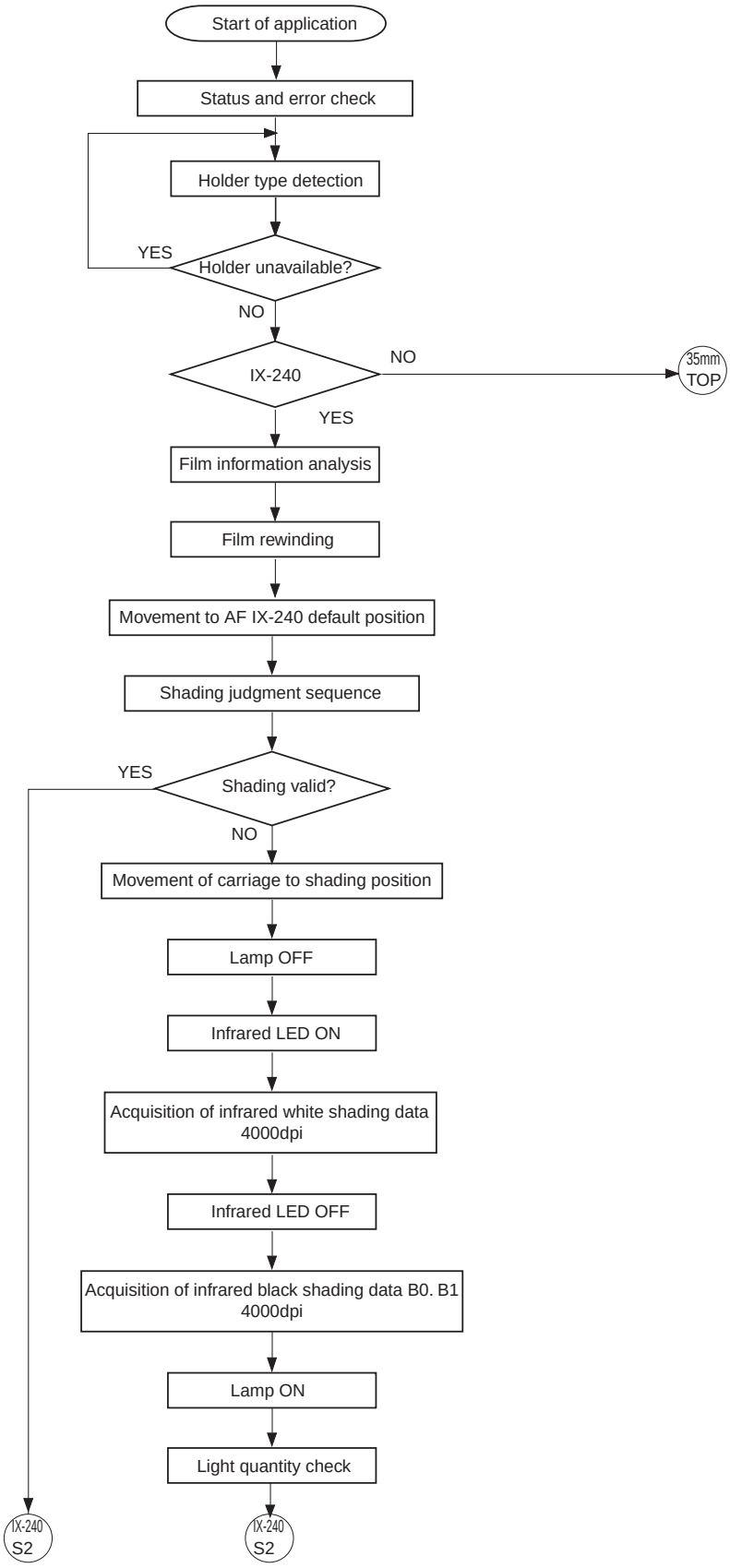

Fig. 2-4-4

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Processing at the start of application and insertion of holder (IX-240 film - 1) continued

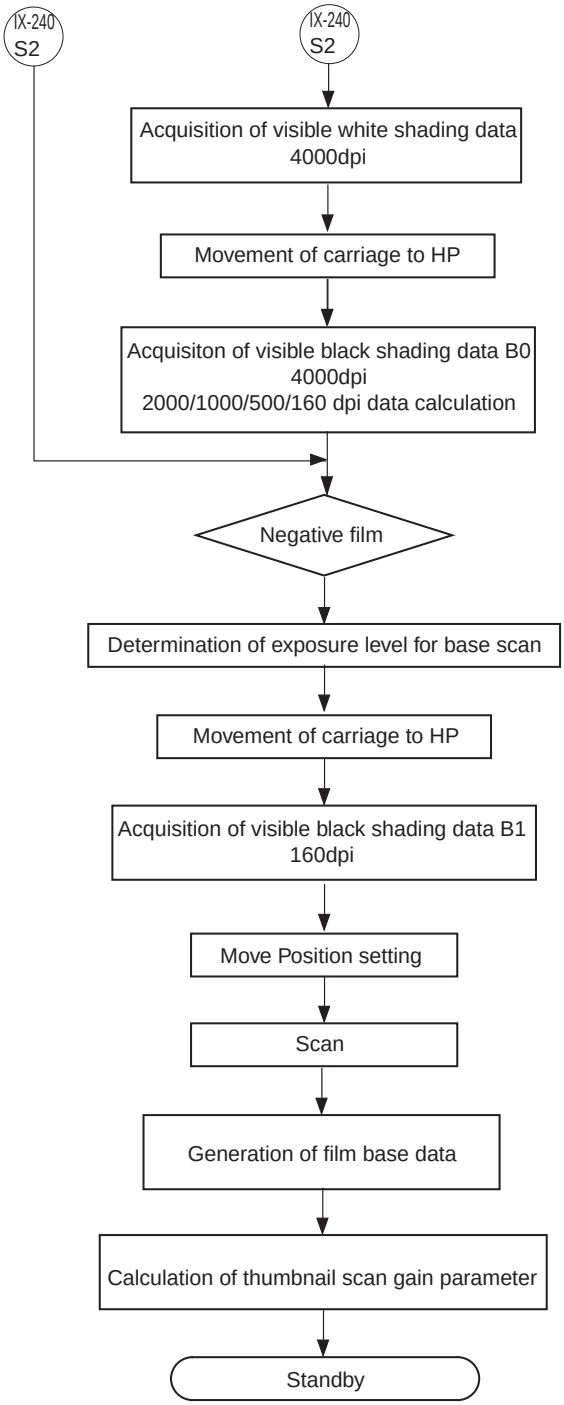

Fig. 2-4-5

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5. Shading acquisition (IX-240 film)

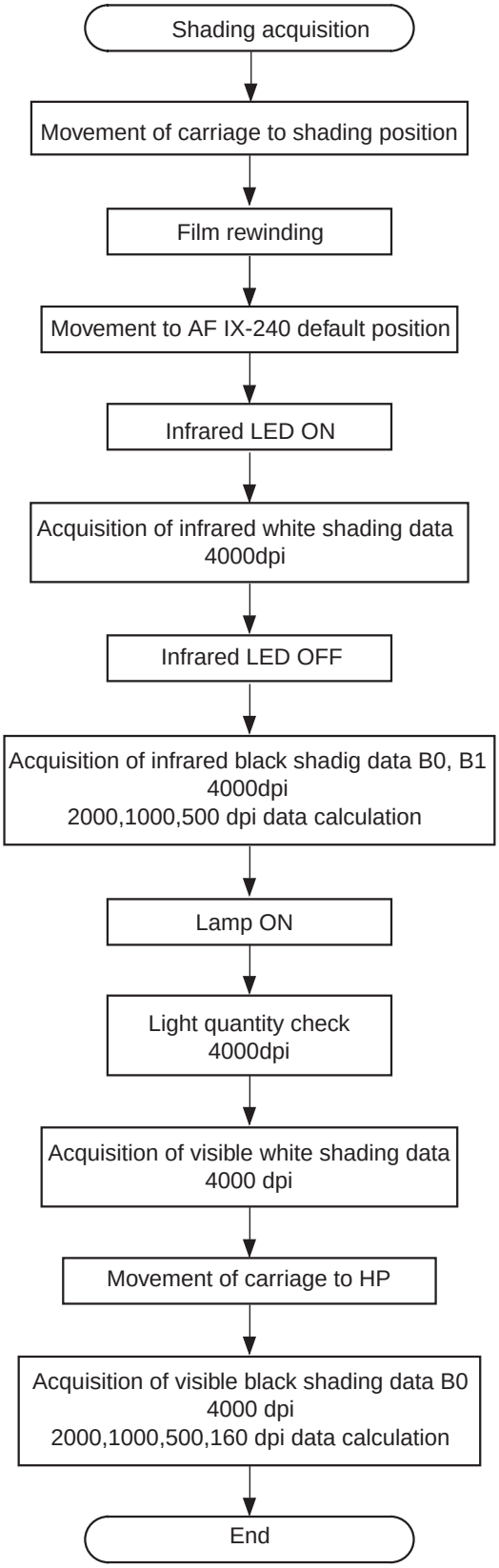

Fig. 2-4-6

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6. High speed thumbnail scan (IX-240 film)

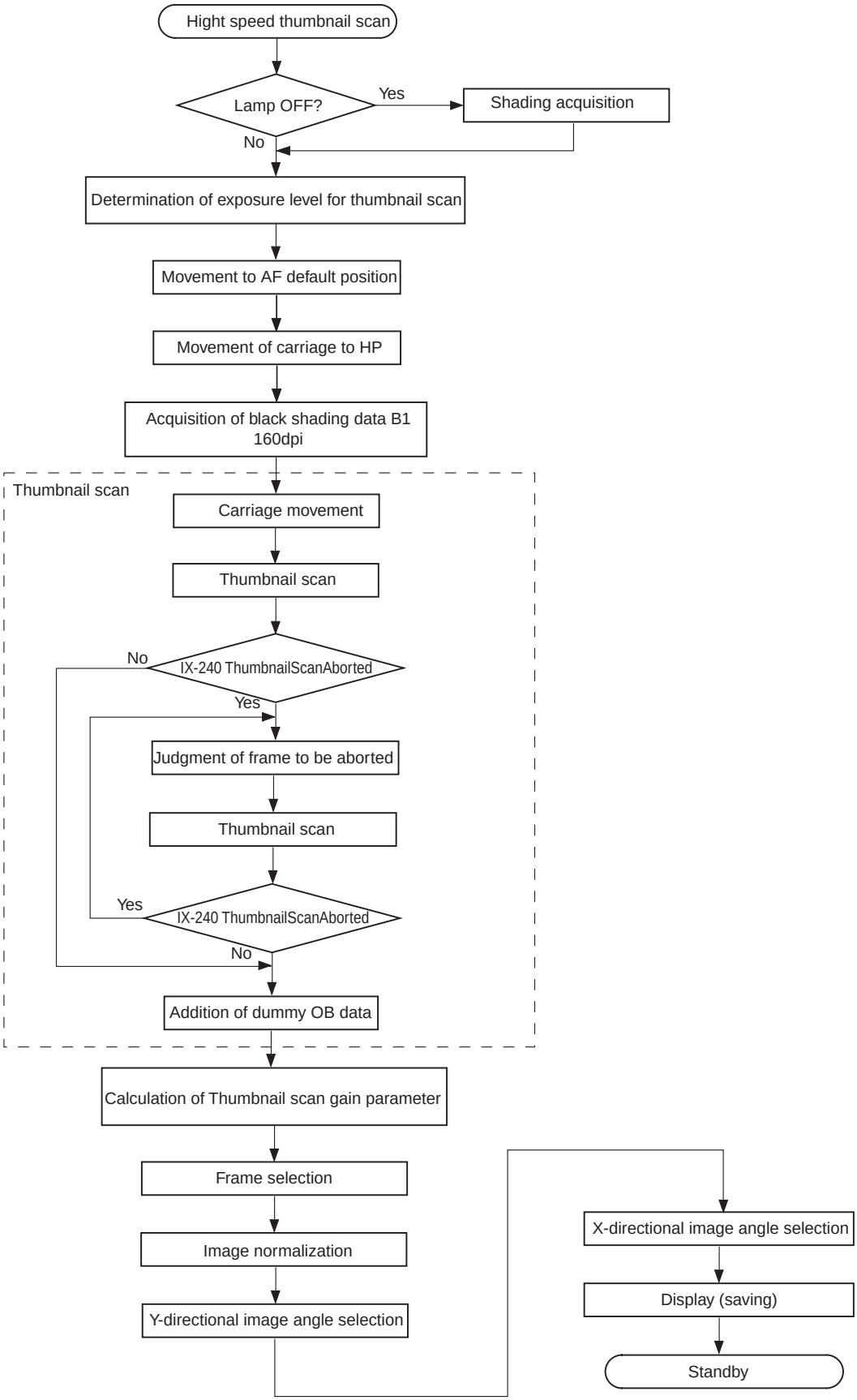

Fig. 2-4-7

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7. Direct scan (IX-240 film)

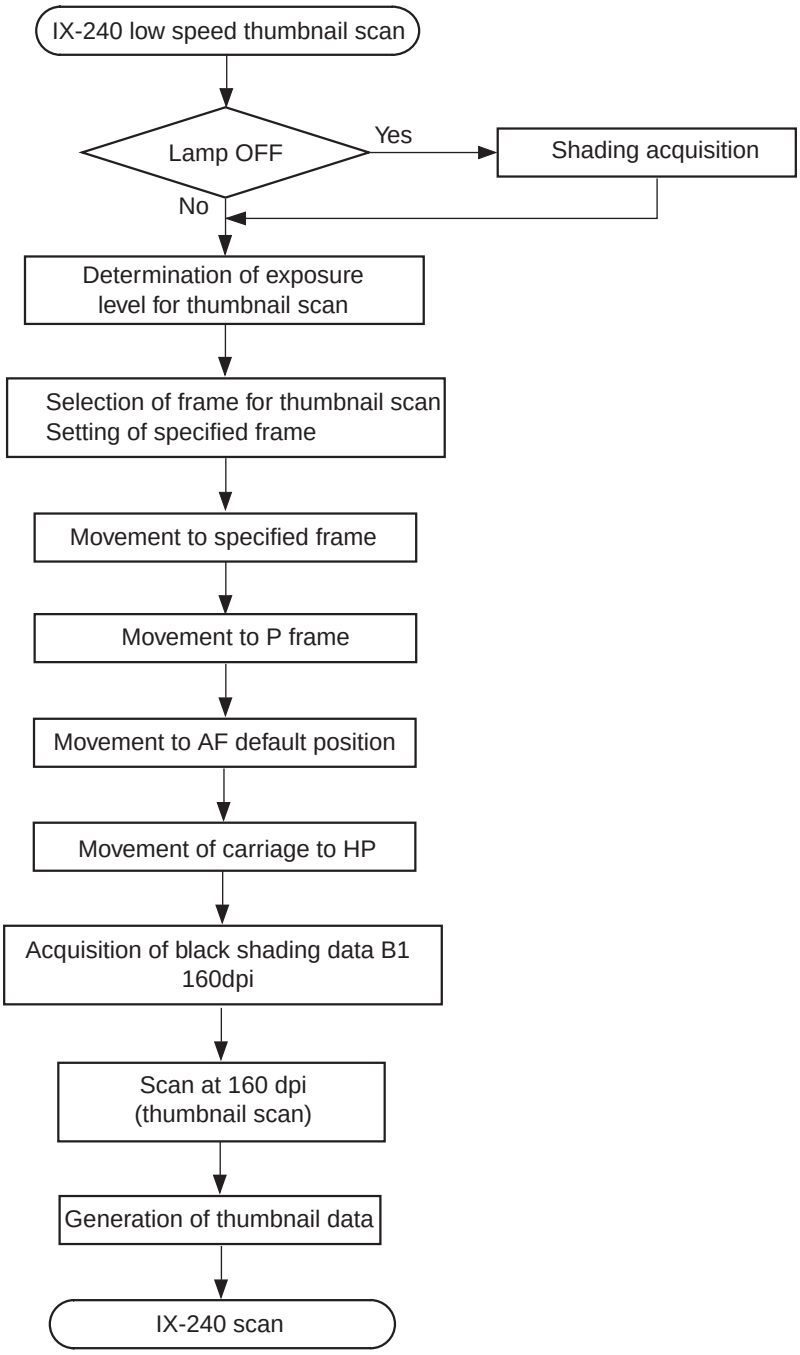
IX-240 low speed thumbnail scan
Lamp OFF
Yes
Shading acquisition
No
Determination of exposure level for thumbnail scan
Selection of frame for thumbnail scan
Setting of specified frame
Movement to specified frame
Movement to P frame
Movement to AF default position
Movement of carriage to HP
Acquisition of black shading data B1 160dpi
Scan at 160 dpi (thumbnail scan)
Generation of thumbnail data
IX-240 scan

Fig. 2-4-8

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8. Preview scan (IX-240 film)

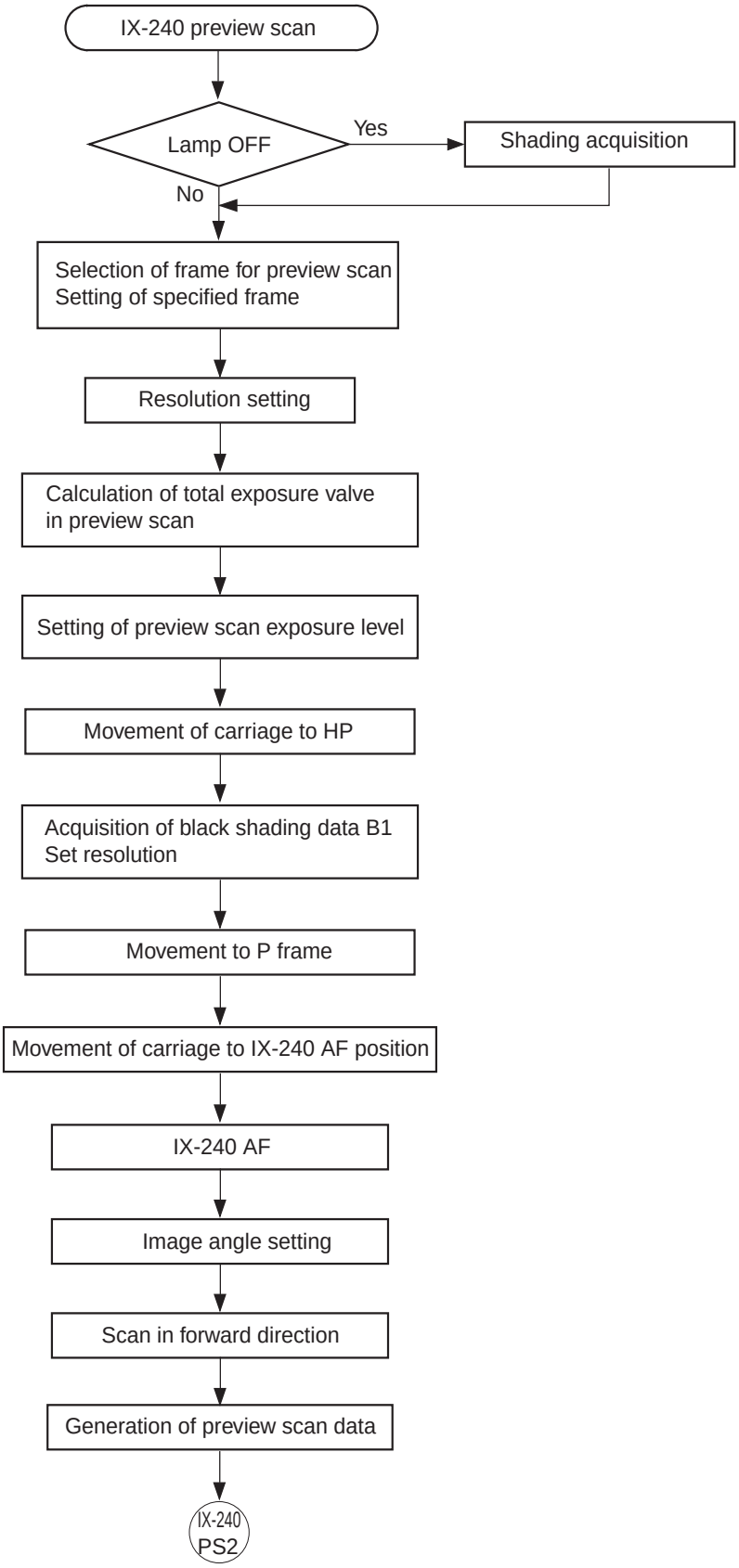

Fig. 2-4-9

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Preview scan (IX-240 film) continued

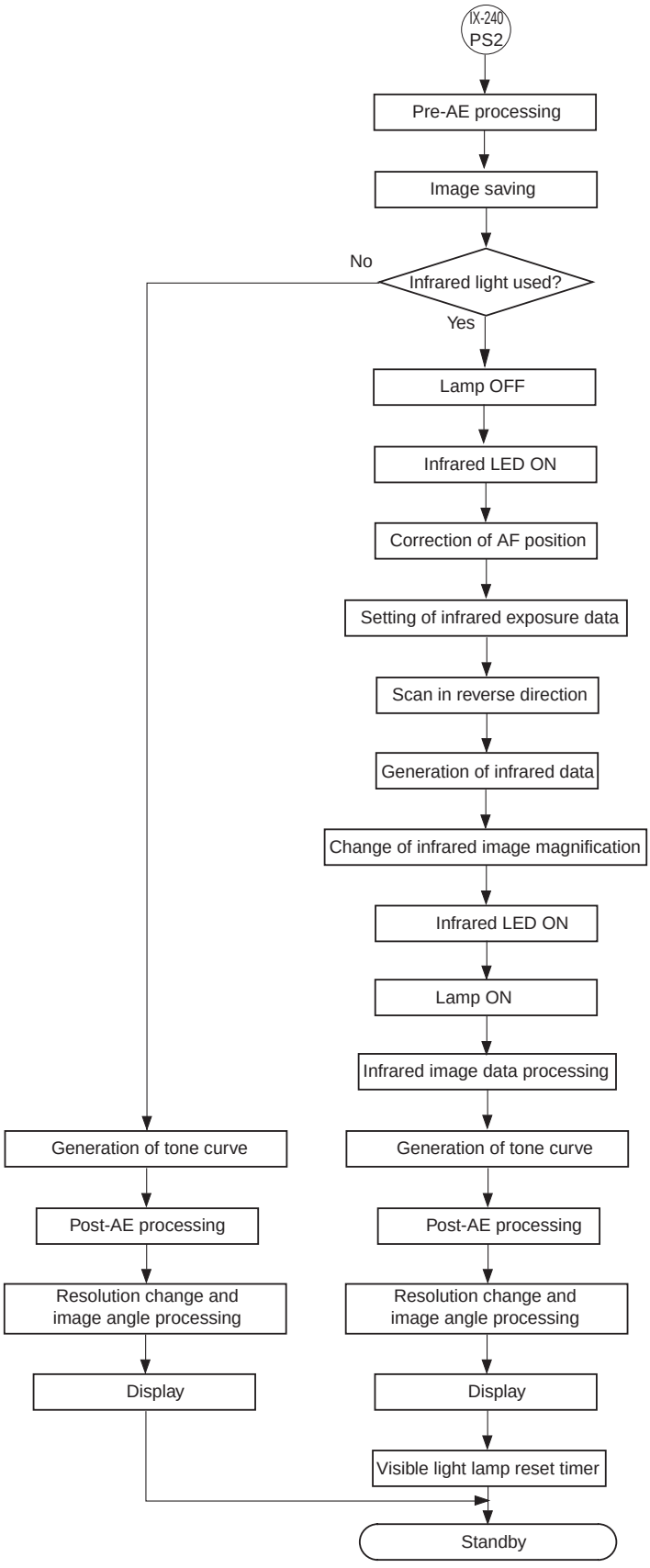

Fig. 2-4-10

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9. Scan (IX-240 film)

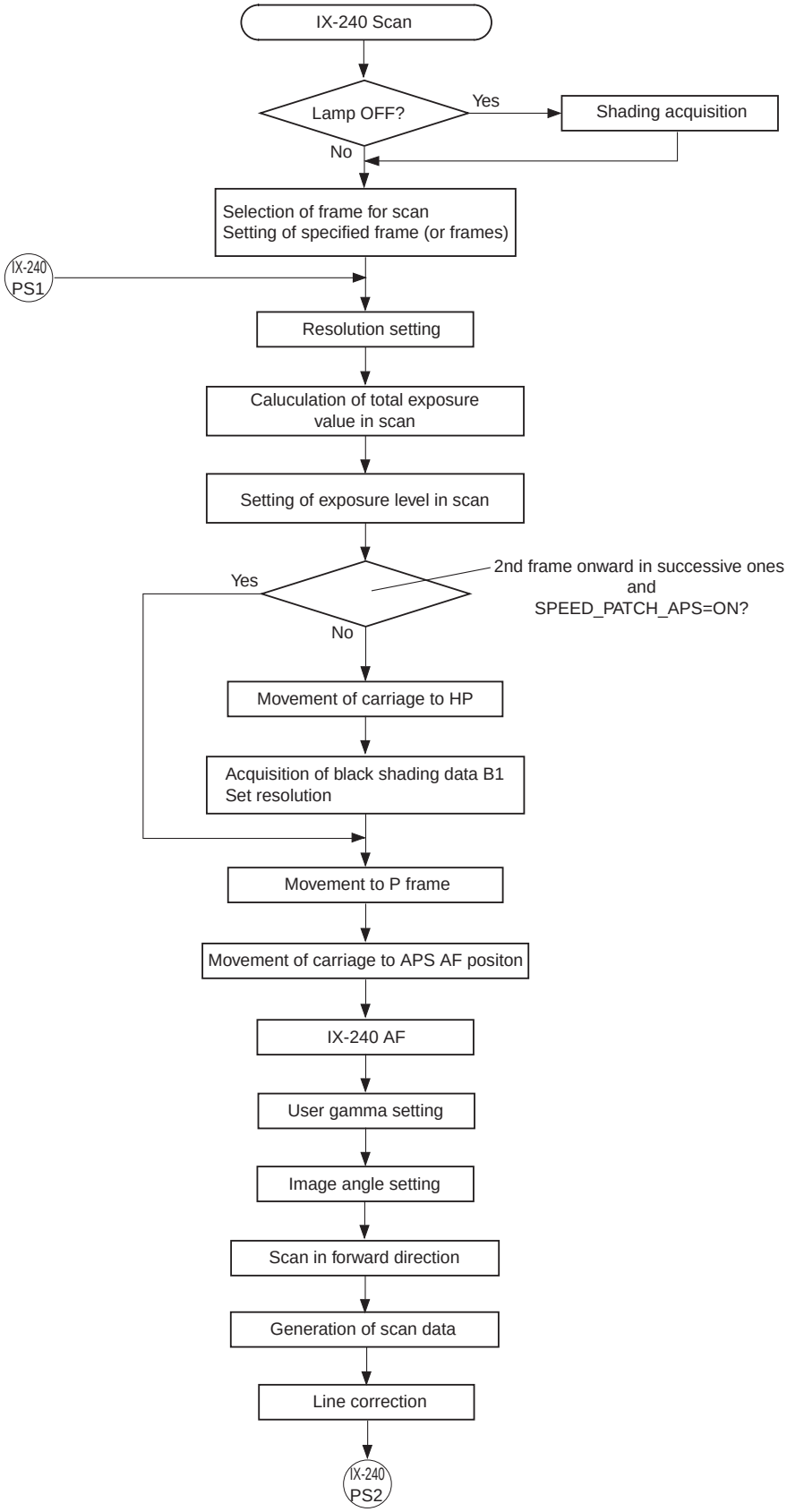

Fig. 2-4-11

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Scan (IX-240 film) continued

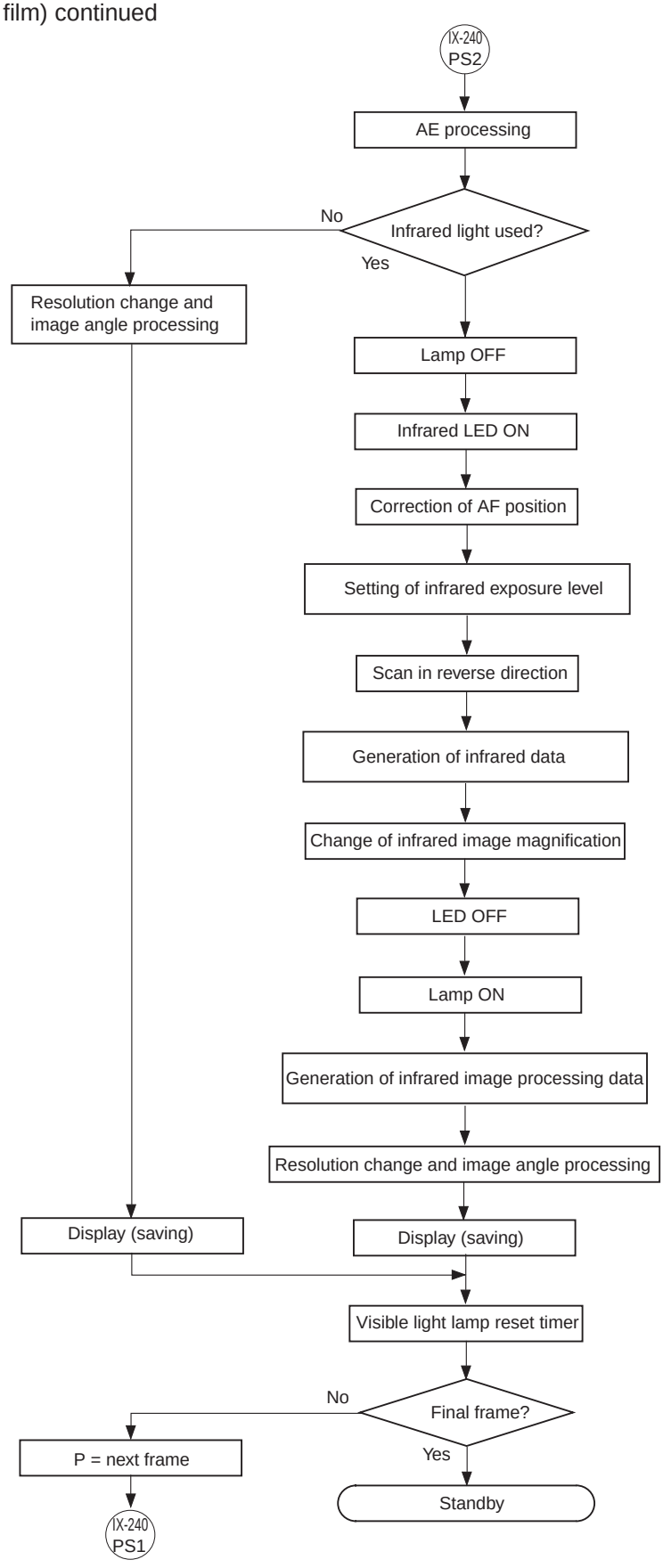

Fig. 2-4-12

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10. Processing at the start the of application and insertion of holder (35mm film)

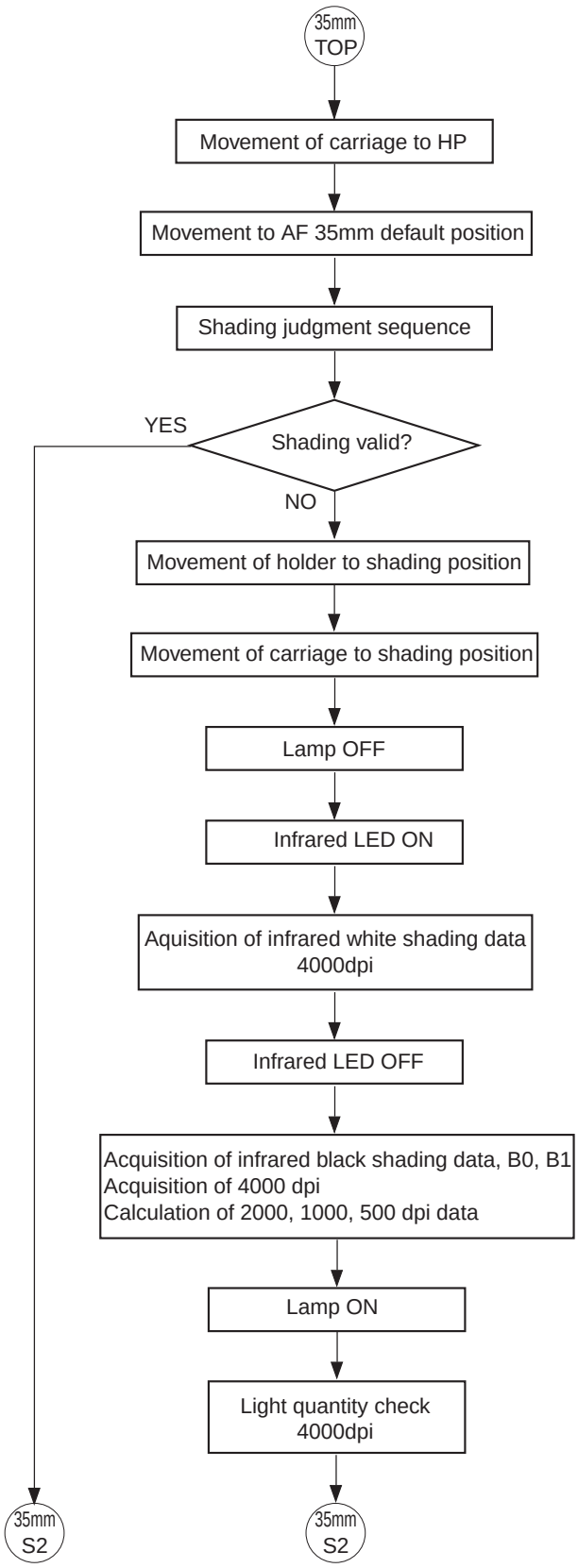

Fig. 2-4-13

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Processing at the start of application and insertion of holder (35mm film) continued

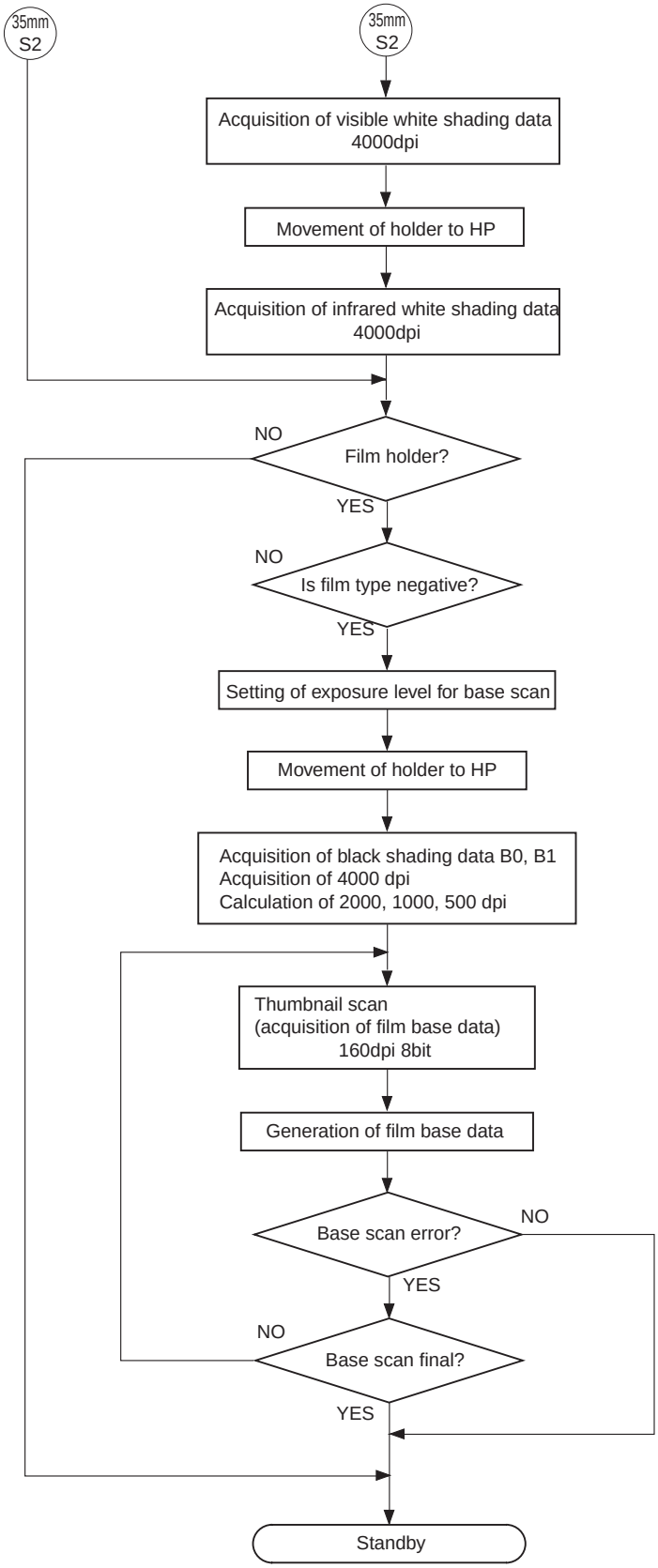

Fig. 2-4-14

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11. Shading acquisition (35mm film)

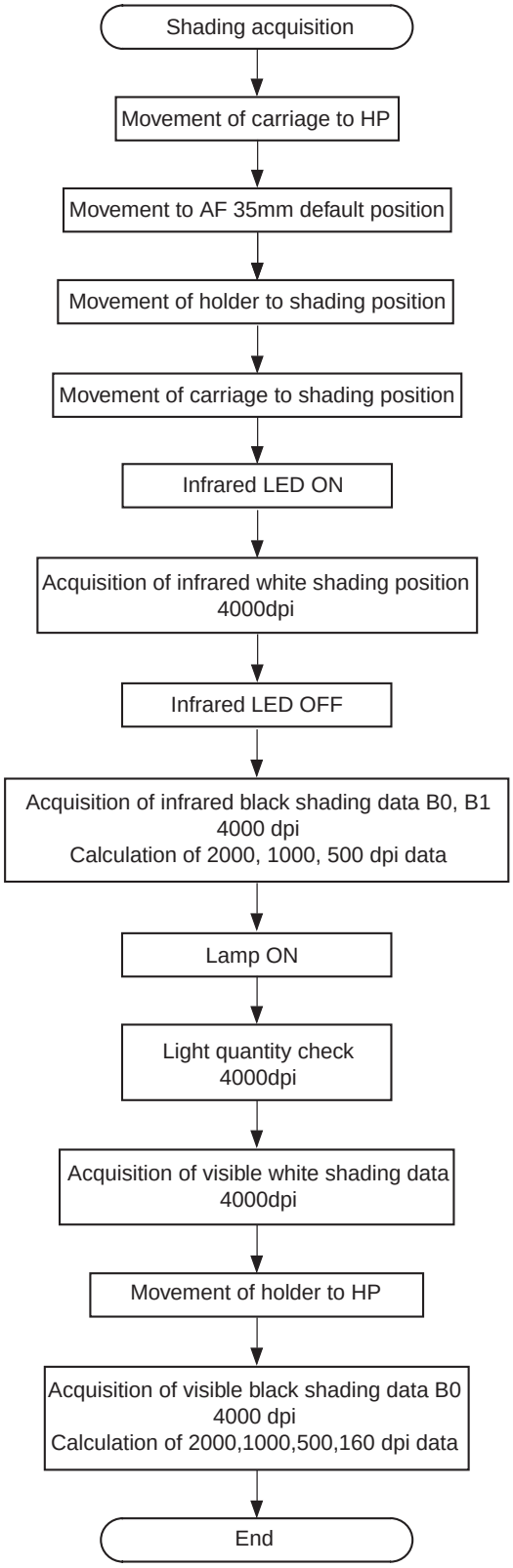
Shading acquisition
Movement of carriage to HP
Movement to AF 35mm default position
Movement of holder to shading position
Movement of carriage to shading position
Infrared LED ON
Acquisition of infrared white shading position
4000dpi
Infrared LED OFF
Acquisition of infrared black shading data B0, B1
4000 dpi
Calculation of 2000, 1000, 500 dpi data
Lamp ON
Light quantity check
4000dpi
Acquisition of visible white shading data
4000dpi
Movement of holder to HP
Acquisition of visible black shading data B0
4000 dpi
Calculation of 2000,1000,500,160 dpi data
End

Fig. 2-4-15

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12. Thumbnail scan (35mm film)

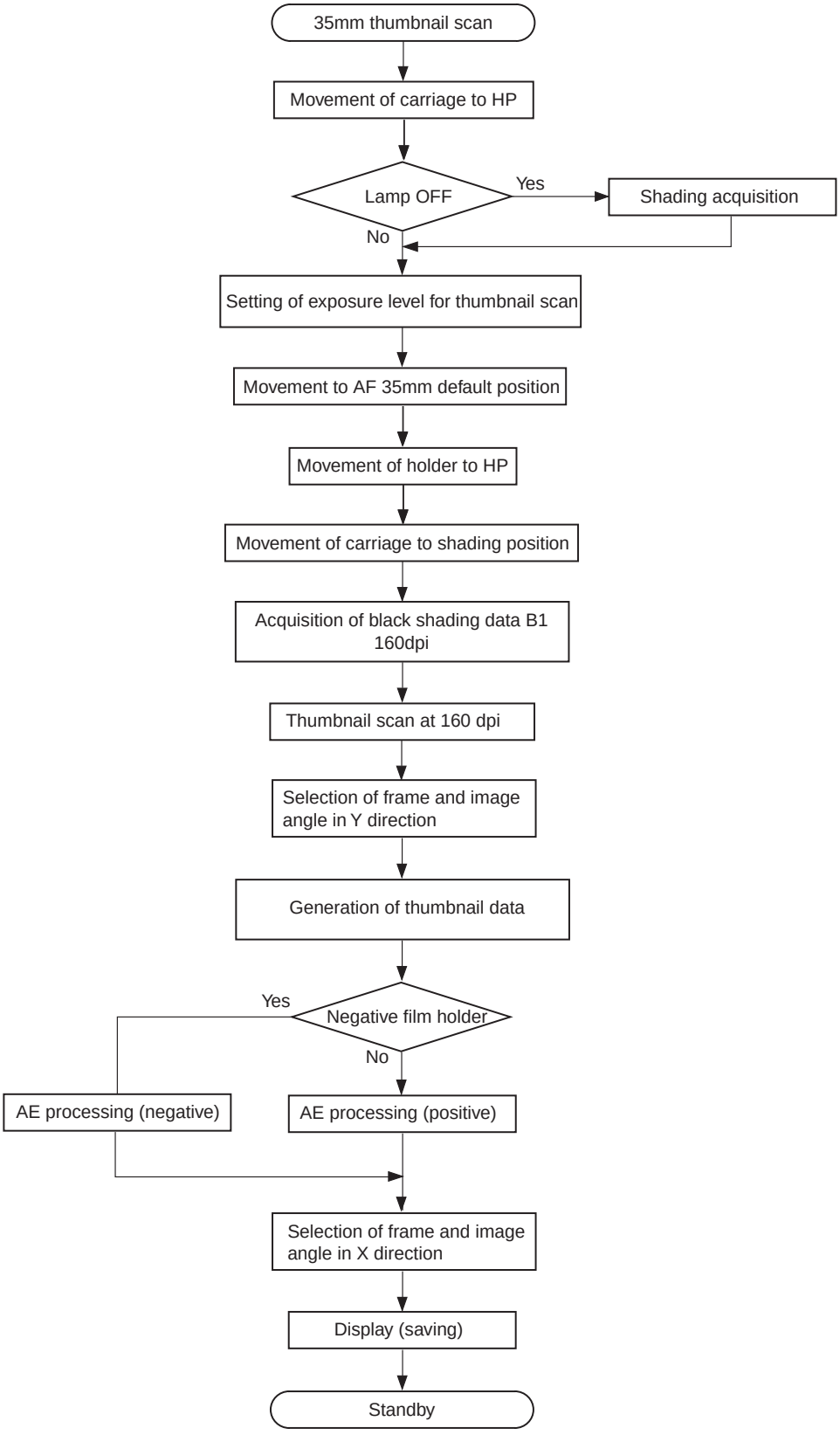

Fig. 2-4-16

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13. Direct scan (35mm film)

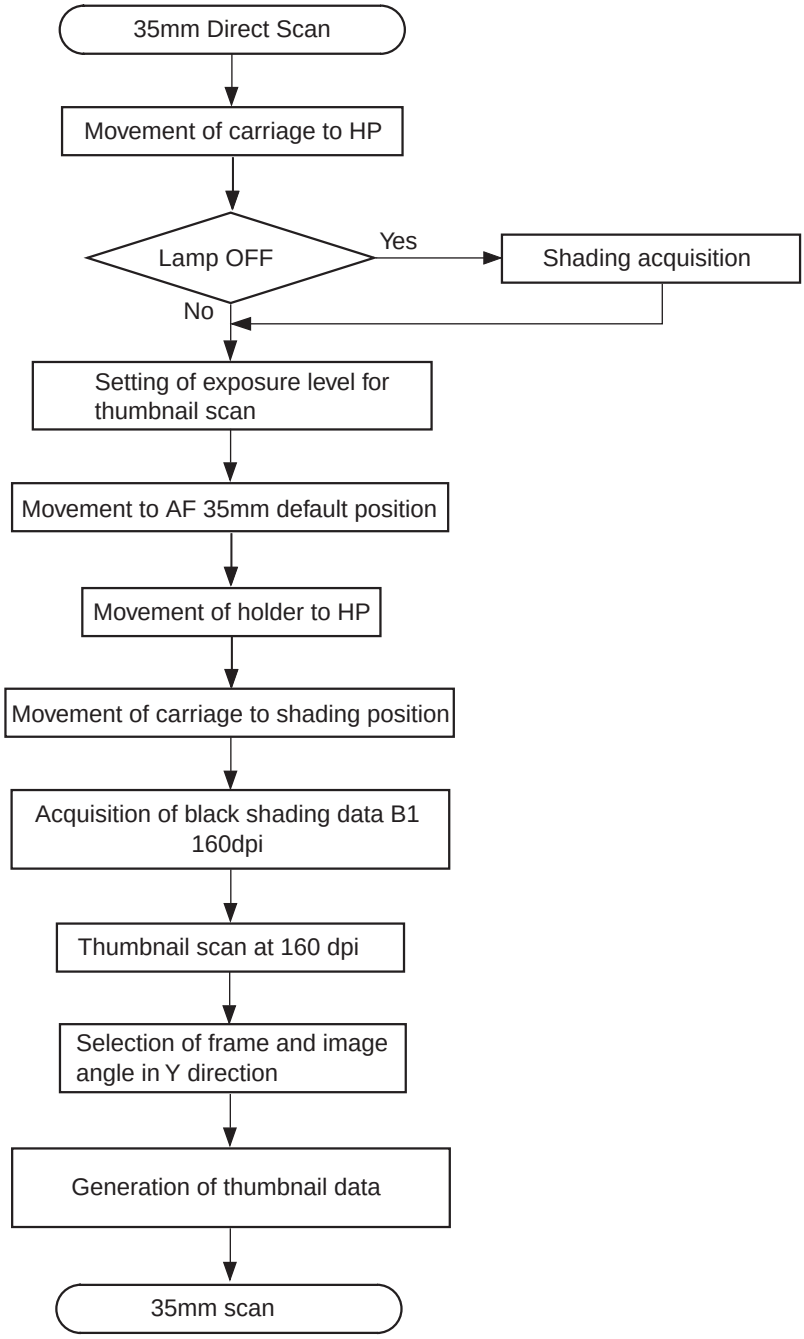
35mm Direct Scan
Movement of carriage to HP
Lamp OFF
Yes
Shading acquisition
No
Setting of exposure level for thumbnail scan
Movement to AF 35mm default position
Movement of holder to HP
Movement of carriage to shading position
Acquisition of black shading data B1 160dpi
Thumbnail scan at 160 dpi
Selection of frame and image angle in Y direction
Generation of thumbnail data
35mm scan

Fig. 2-4-17

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14. Preview scan (35mm film)

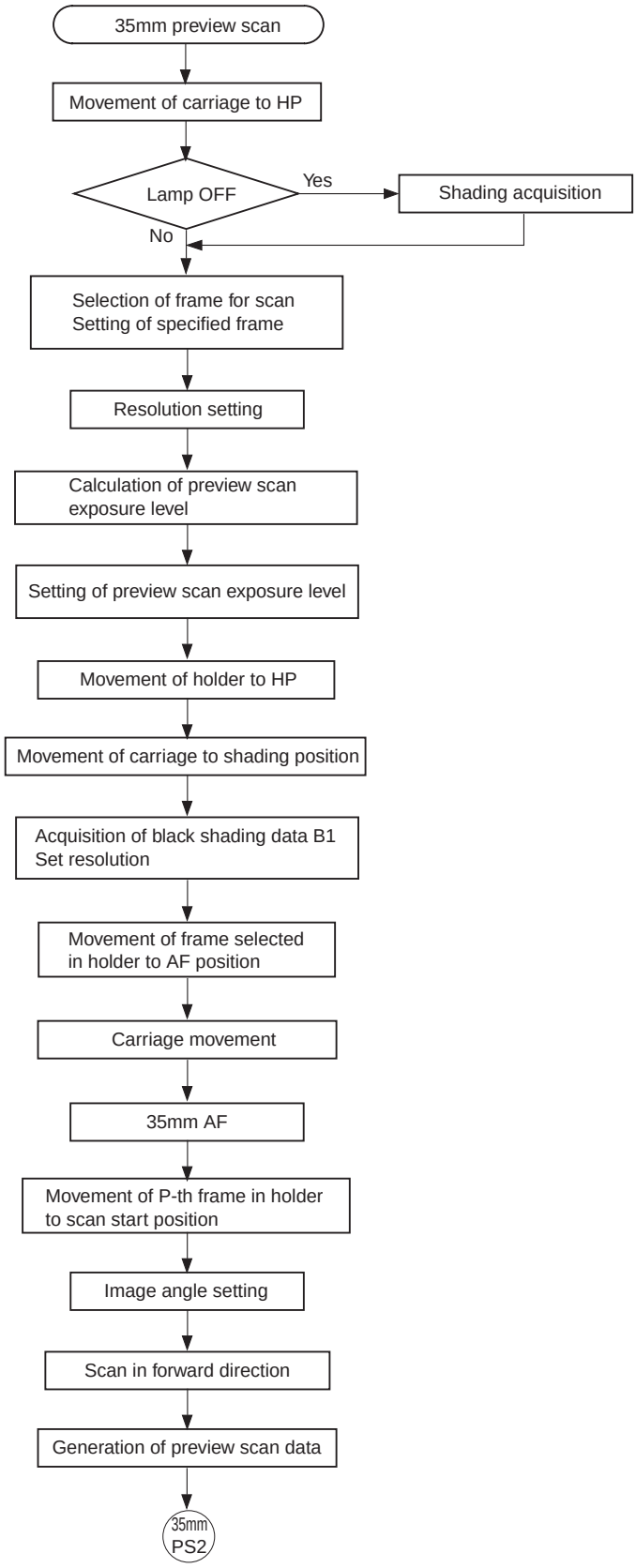
35mm preview scan
Movement of carriage to HP
Lamp OFF
Yes
Shading acquisition
No
Selection of frame for scan
Setting of specified frame
Resolution setting
Calculation of preview scan exposure level
Setting of preview scan exposure level
Movement of holder to HP
Movement of carriage to shading position
Acquisition of black shading data B1
Set resolution
Movement of frame selected in holder to AF position
Carriage movement
35mm AF
Movement of P-th frame in holder to scan start position
Image angle setting
Scan in forward direction
Generation of preview scan data
35mm PS2

Fig. 2-4-18

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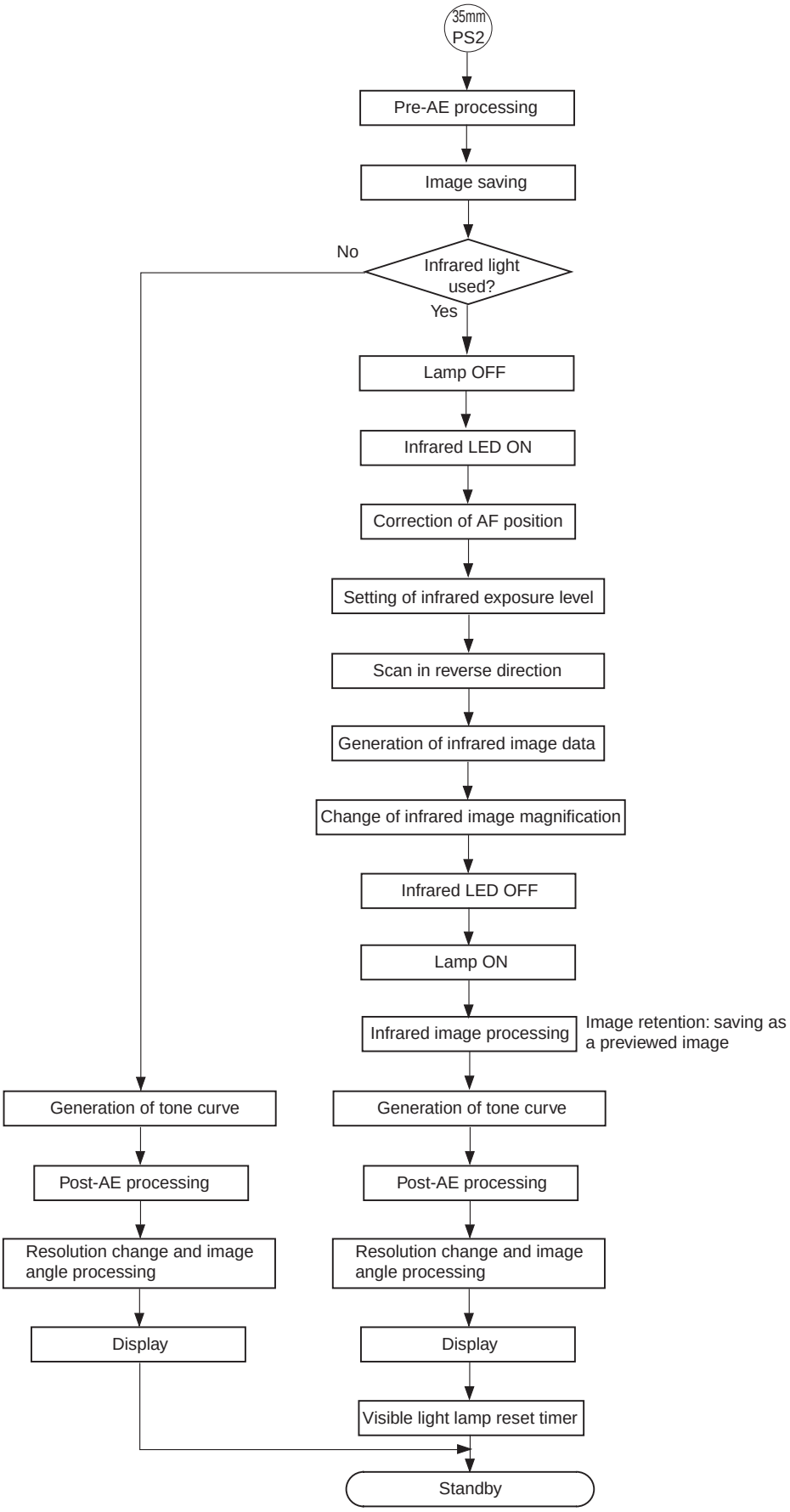

Fig. 2-4-19

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15. Scan (35mm film)

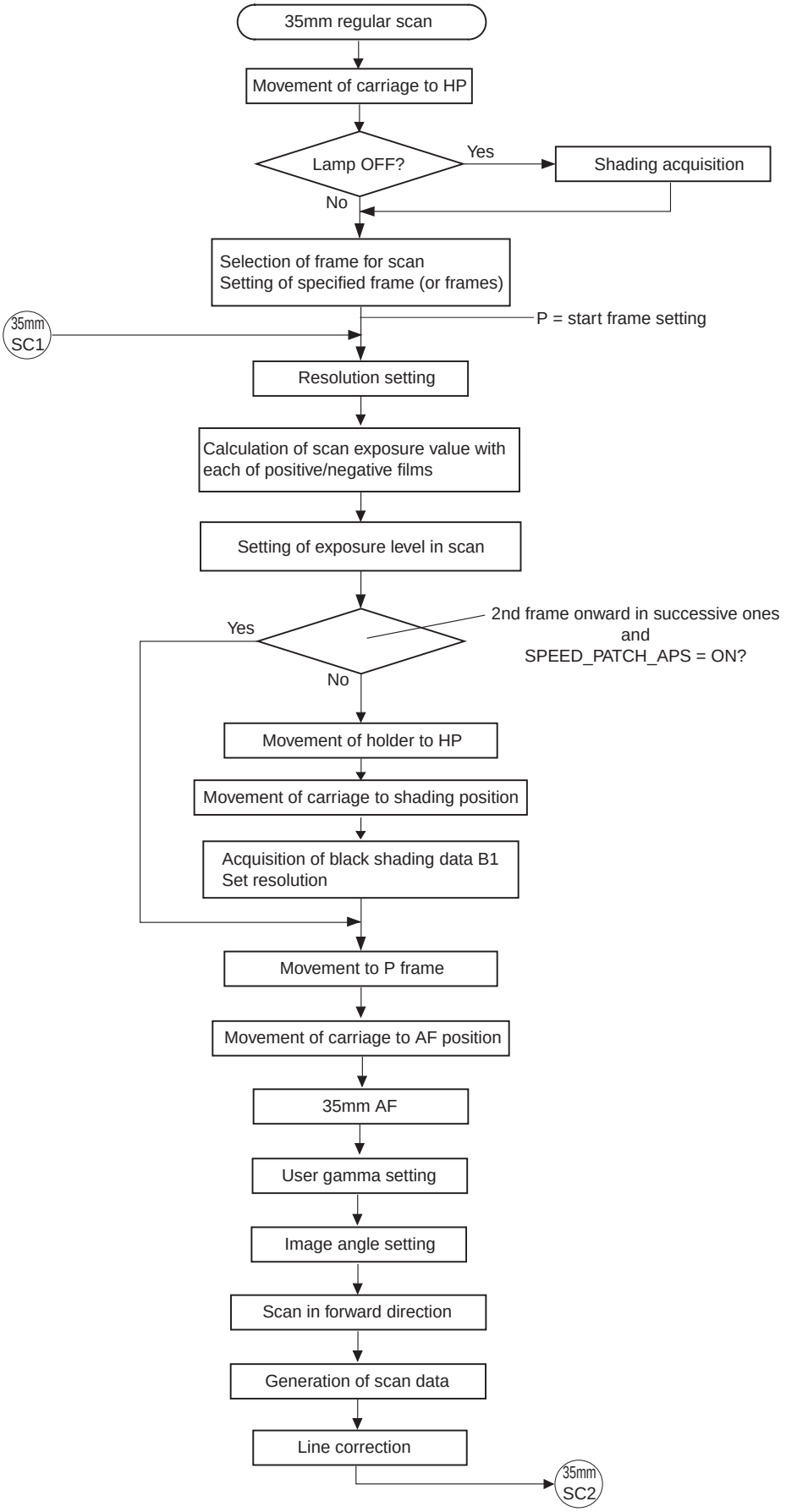

Fig. 2-4-20

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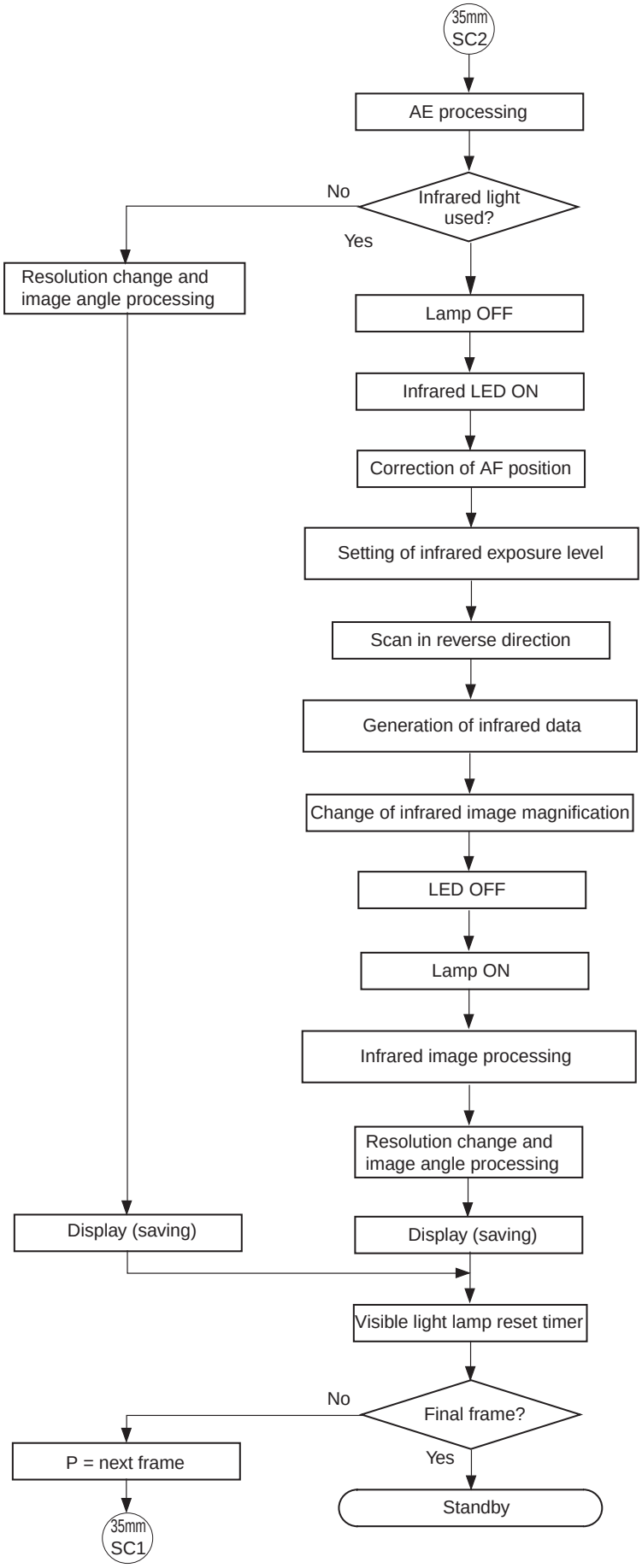

Fig. 2-4-21

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16. Data flowchart

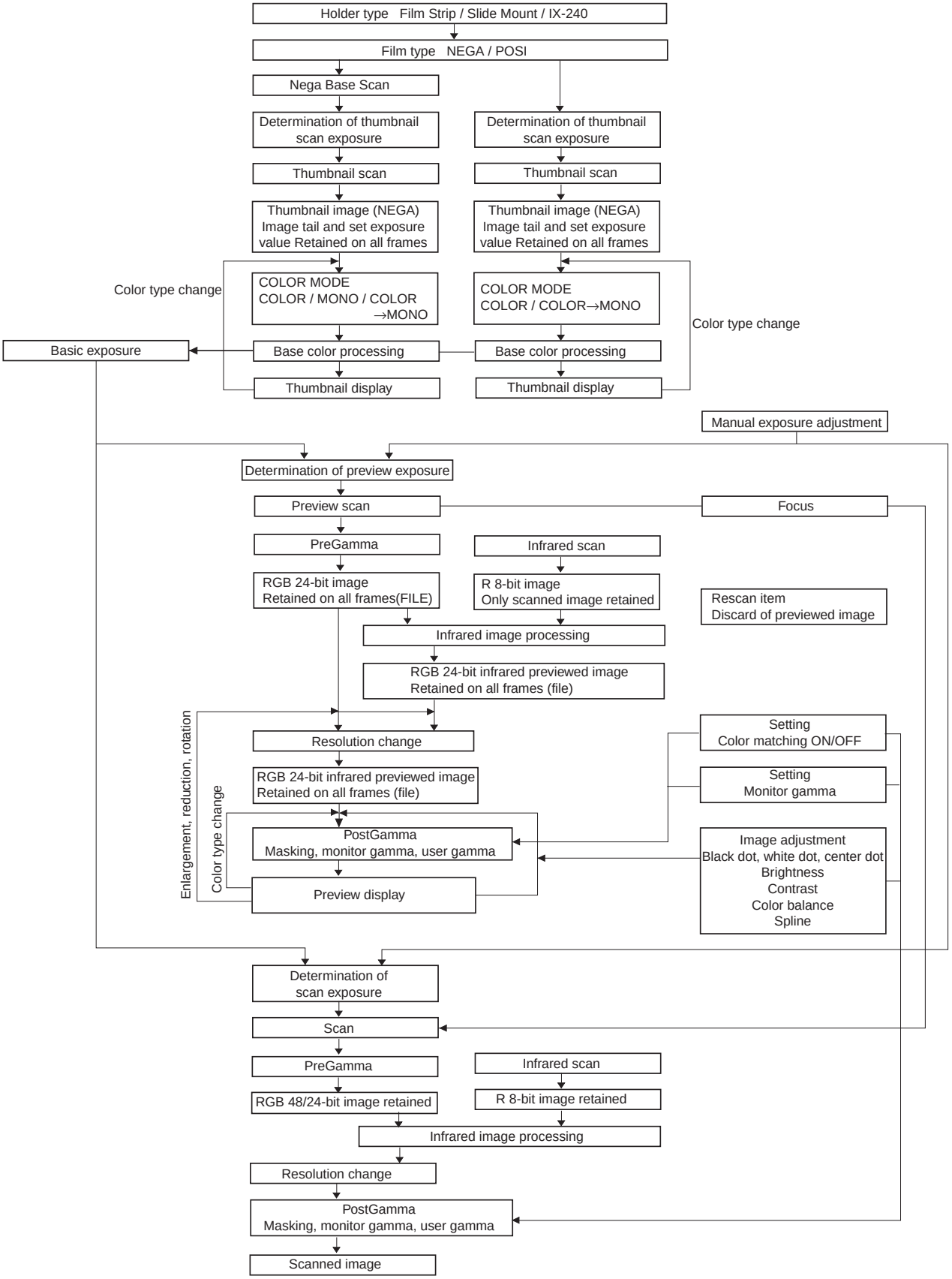
Holder type Film Strip / Slide Mount / IX-240
Film type NEGA / POSI
Nega Base Scan
Determination of thumbnail scan exposure
Thumbnail scan
Thumbnail image (NEGA) Image tail and set exposure value Retained on all frames
Color type change
COLOR MODE COLOR / MONO / COLOR →MONO
Basic exposure
Base color processing
Thumbnail display
Determination of thumbnail scan exposure
Thumbnail scan
Thumbnail image (NEGA) Image tail and set exposure value Retained on all frames
COLOR MODE COLOR / COLOR→MONO
Color type change
Base color processing
Thumbnail display
Manual exposure adjustment
Determination of preview exposure
Preview scan
Focus
PreGamma
Infrared scan
RGB 24-bit image Retained on all frames(FILE)
R 8-bit image Only scanned image retained
Rescan item Discard of previewed image
Infrared image processing
RGB 24-bit infrared previewed image Retained on all frames (file)
Enlargement, reduction, rotation
Color type change
Resolution change
RGB 24-bit infrared previewed image Retained on all frames (file)
PostGamma Masking, monitor gamma, user gamma
Preview display
Setting Color matching ON/OFF
Setting Monitor gamma
Image adjustment Black dot, white dot, center dot Brightness Contrast Color balance Spline
Determination of scan exposure
Scan
PreGamma
Infrared scan
RGB 48/24-bit image retained
R 8-bit image retained
Infrared image processing
Resolution change
PostGamma Masking, monitor gamma, user gamma
Scanned image

Fig. 2-4-22

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Memo

II OPTICAL BLOCK

A. Outline

The optical block covers the function for exposing a film with the film illumination lamp and focusing the transmitted light onto CCD.

Besides the conventional film reading function with visible light, this scanner incorporates a function for detecting dust and scratch on a film with infrared light (hereafter called FARE: Film Automatic Retouching and Enhancement). Therefore, a mercury cathode fluorescent tube is used as a film illuminating visible light lamp and an IRED is used as a film illuminating infrared light lamp. These lamps are changed over appropriately according to the CPU circuit. Also, a visible light image is acquired in forward run and an infrared image is acquired in reverse run.

For recognizing the color of a film, the scanner adopts a 3-line CCD that incorporates each filter of RGB.

The carriage drive motor rotates according to a drive signal from the main circuit board and turns a feed screw (drive shaft) through gear to drive the carriage.

The film holder drive motor rotates according to a drive signal from the main circuit board and turns the film holder through gear.

The focus drive motor rotates according to a drive signal from the main circuit board and carries out AF action by moving the focus unit through a nut.

In addition, this scanner has a contact unit for automatically feeding IX-240 films. So, when you insert the IX-240 Film cartridge holder into the scanner, the contact unit functions to connect them automatically for power supply and signal exchange.

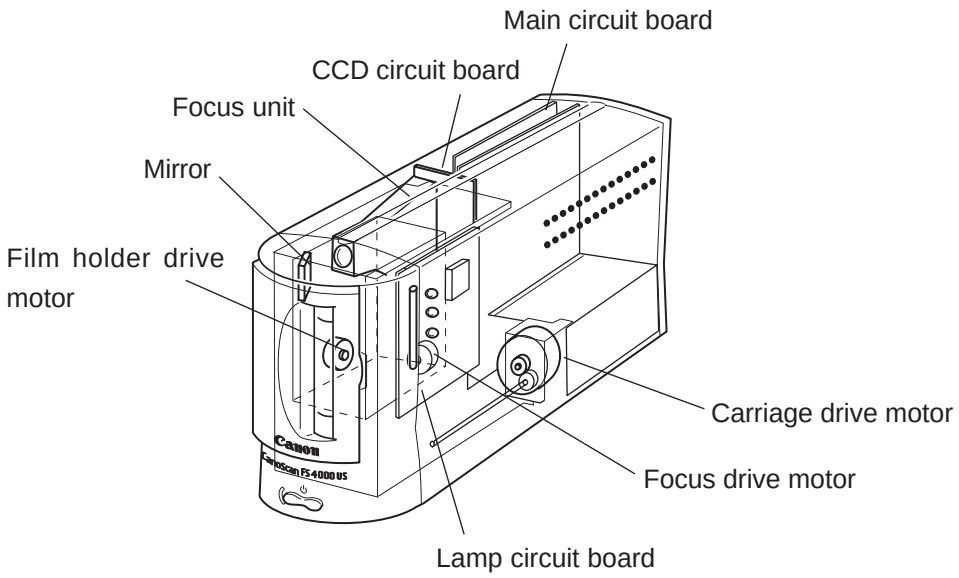

Fig. 2-5

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B. Film illumination lamp lighting circuit

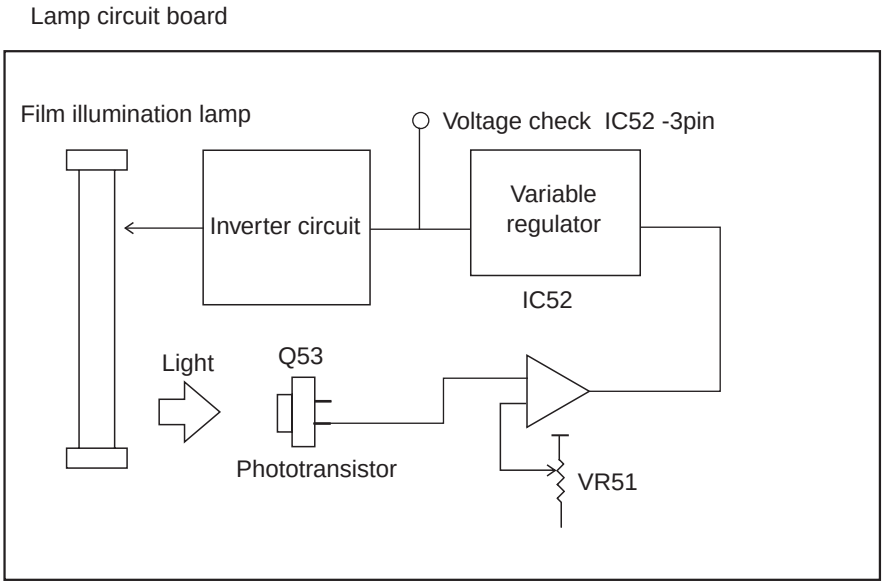

Fig. 2-6

For stabilizing the light quantity of lamp, a light quantity feedback stabilizing circuit dependent on a phototransistor is provided.

The light quantity is measured with phototransistor Q53 to control variable regulator IC52. The output voltage of the regulator is varied so that the light quantity is kept constant. Note that VR51 is an adjusting variable resistor used to compensate for slight differences among the elements of lamp circuit board. Adjustment is made so that the output voltage of the variable regulator IC52-3pin reaches 9.95 to 10.0 V in 5 to 10 minutes after lamp ON.

If this adjustment is unsatisfactory, phenomena such as slow lighting of lamp and unstable light quantity will occur to cause a stripe noise on a scanned image.

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C. Motor control circuit

This scanner uses 3 motors; carriage drive motor for driving the carriage, film holder drive motor for driving the film holder and focus drive motor for driving the focus unit so as to focus light on a film.

Fig. 2-7 shows a block diagram of the motor control circuit.

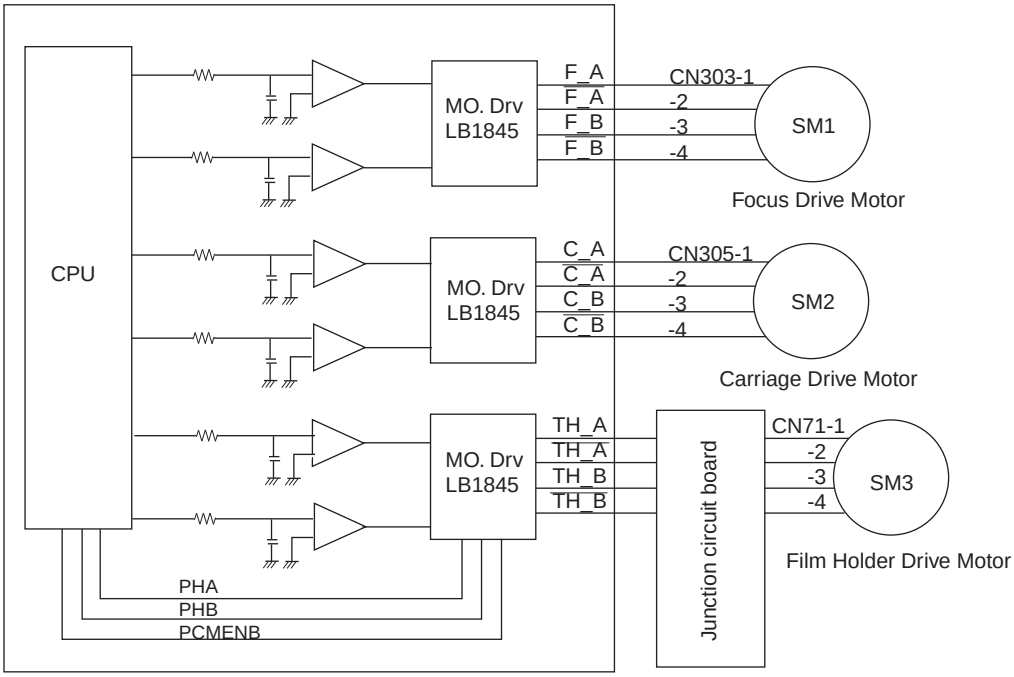

Fig. 2-7

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C-1.Carriage drive motor

CPU analyzes a command sent from external equipment via a gate array and generates stepping motor control clock PHA/PHB according to magnification. The stepping motor control clock is converted into 4-phase motor drive signals (C_A, $\overline{C\_A}$, C_B, $\overline{C\_B}$) with an amplifier and motor driver.

When external equipment has changed reading resolution, CPU will change 1) the pulse width of stepping motor control clock, 2) the revolving speed of carriage drive motor and 3) motor drive current control signal (FCMSINA, FCMSINB), thereby generating a torque suited for the revolving speed.

When the carriage advances, the motor speed changes with reading resolution, and it remains constant when the carriage reverses.

C-2.Film holder drive motor

CPU analyzes a command sent from external equipment via a gate array, and drives the film holder so as to bring a film frame held on the film holder, and the window and light shielding section for acquiring black and white shadings onto the optical path.

There are two drive speeds each for start and steady movement.

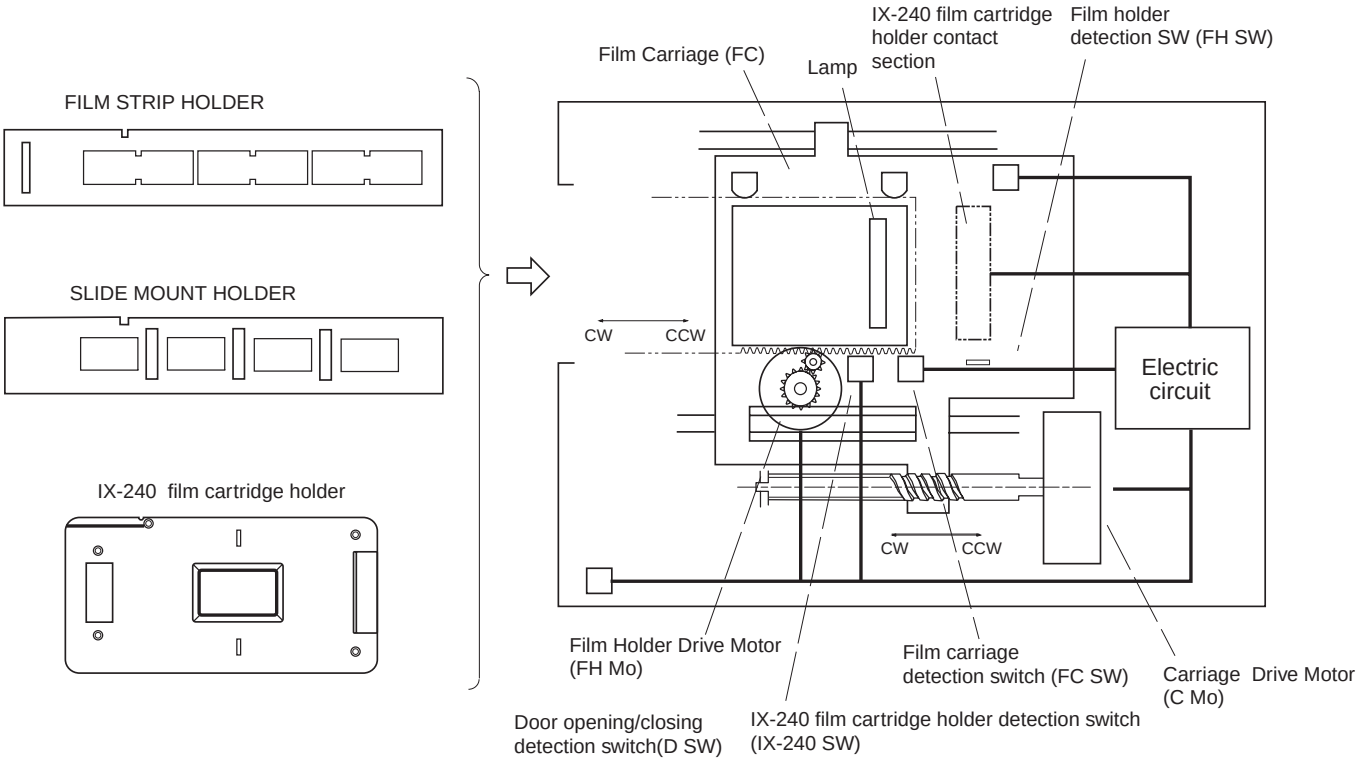

Fig. 2-8

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C-2.Focus drive motor

Focus unit drive signal is a clock signal (AFENB) from the gate array and it is converted into 4-phase motor driver pulse signals through the motor driver. This driver supplies +14 V power supply to the focus drive motor and controls the voltage.

The focus unit is illustrated in Fig. 2-9. The lens and CCD are fixed with the determined clearance to compose a unit structure. When the focus drive motor turns in the determined direction, the distance against film surface changes in the determined quantity.

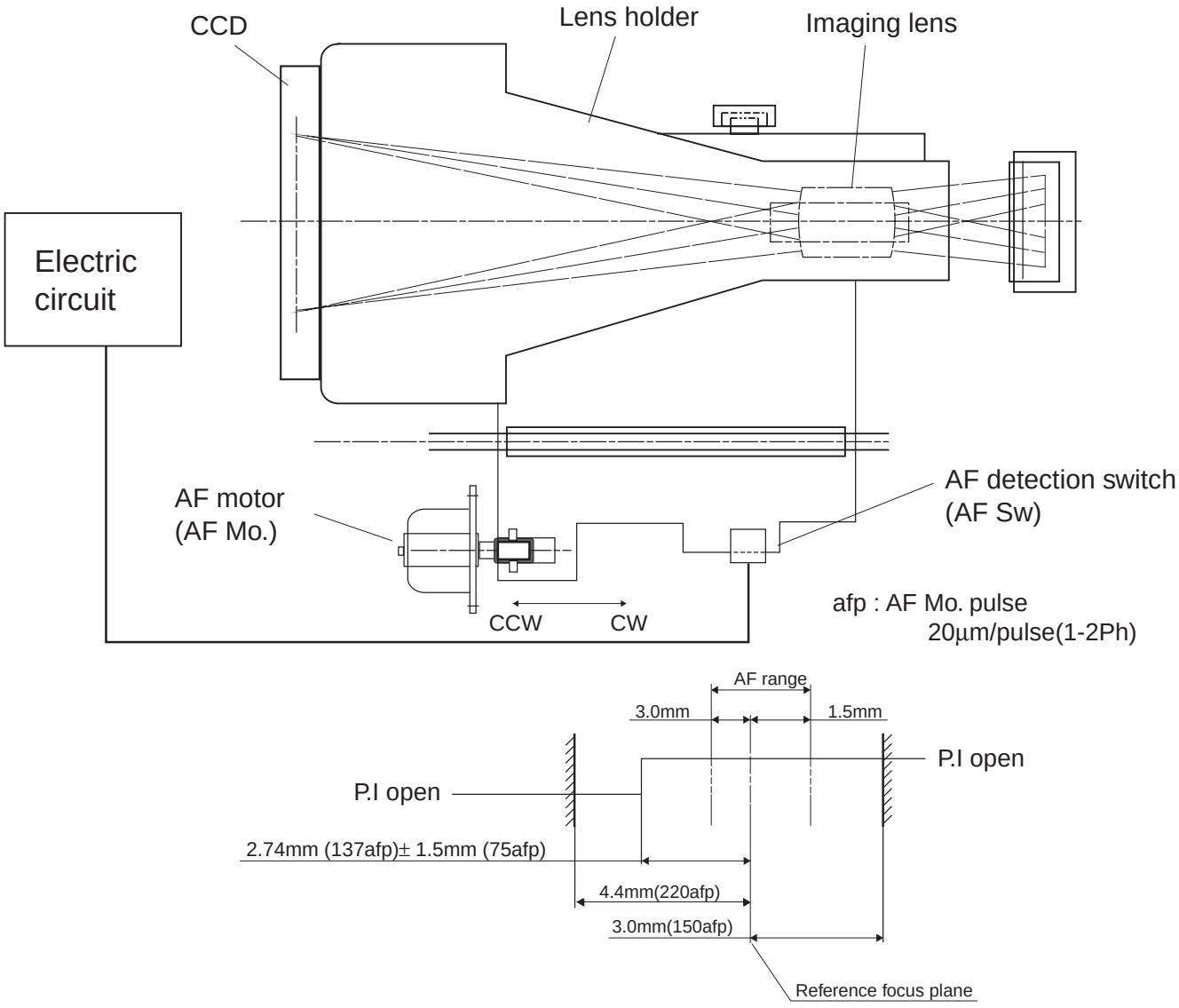

Fig. 2-9

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When external equipment specifies AF, the focus drive motor is rotated and the home position is detected with Photo Interrupter (PI). From the home position, the motor turning direction is reversed, and red, green and blue signals at the film center are read while moving the focus unit at a speed matching film exposure time. At this location, focus calculation is performed and the optimum focus position is determined. The focus unit is returned to the home position by reversing the motor turning direction, and then it is driven to the focus position by reversing the motor turning direction again and stopped there.

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III IMAGE PROCESSING BLOCK

A. Outline

Fig. 2-10 shows a block diagram which represents the main functions of the image processing block. In this block, an optical signal read from CCD is converted into an electric signal and after undergoing various image processings, the signal is sent as a final image from the Twain driver to parent application.

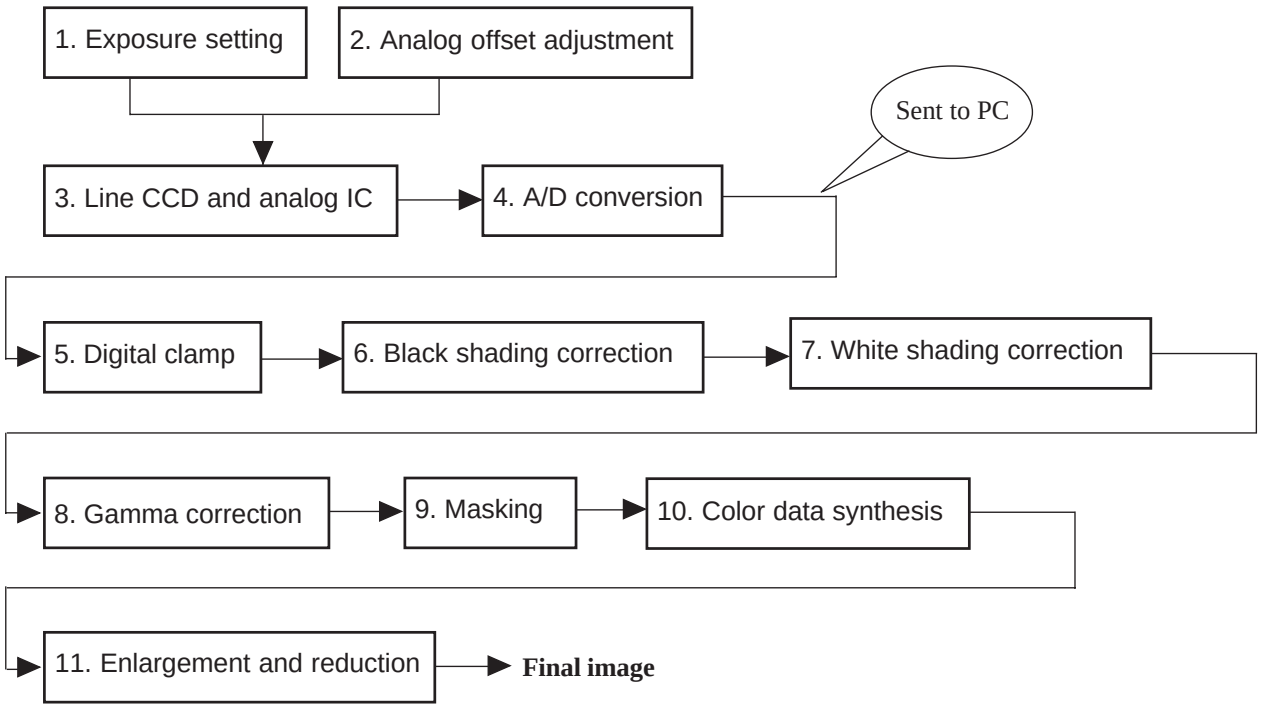

Fig. 2-10

B. Image processing

1) Exposure setting

Exposure to be accumulated on CCD is determined.

Set value of exposure can be roughly classified as follows.

Exposure type	Light source	Information source for exposure calculation
For thumbnail	Visible light lamp	Exposure is determined according to information about factory adjustment.
For preview and scan	Visible light lamp	Appropriate exposure is calculated based on image due to scan by thumbnail exposure to determine exposure.
For dust/scratch detection	Infrared LED	Fixed value recorded in EEPROM

Table 2-1

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2) Analog offset adjustment

Offset level should ideally be 0 mV. However, because a noise signal is imposed on an analog image signal, voltage level may fall below 0 due to noise in case of images of low-transmittance films. This may cause signal omission in A/D conversion.

To circumvent this, this scanner makes adjustment so as to provide an offset of 20 mV at the initial stage of CCD.

3) Line CCD and analog IC

This scanner uses a 3-line CCD for reading color signals.

The 3-line CCD used in this scanner is a 1-chip photoelectric conversion element in which 4,000 light receiving elements of a few micron square are laid in 1 row for each of red, green and blue (3 rows in total) and a circuit for providing a scanning function is incorporated. (See Fig. 2-11.)

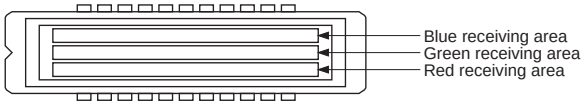

Fig. 2-11

When the light from the film illumination lamp passes through a film and reaches a photodiode (PD) in Fig. 2-12, a current flows in the (⇨) direction.

As a result, a charge corresponding to light quantity is accumulated in a capacitor (C).

When contacts of the switches (SWs) in the shift section close (all contacts close simultaneously), the charges of all pixels are sent to the transmission section at the same time.

The transmission section transmits the charges, which have been sent by phase-shifted transmission pulses F1N and F2N, sequentially in the arrow direction (⇨).

The transmitted charges are converted into voltage signals in the amplifier section and externally output as red, green and blue image signals.

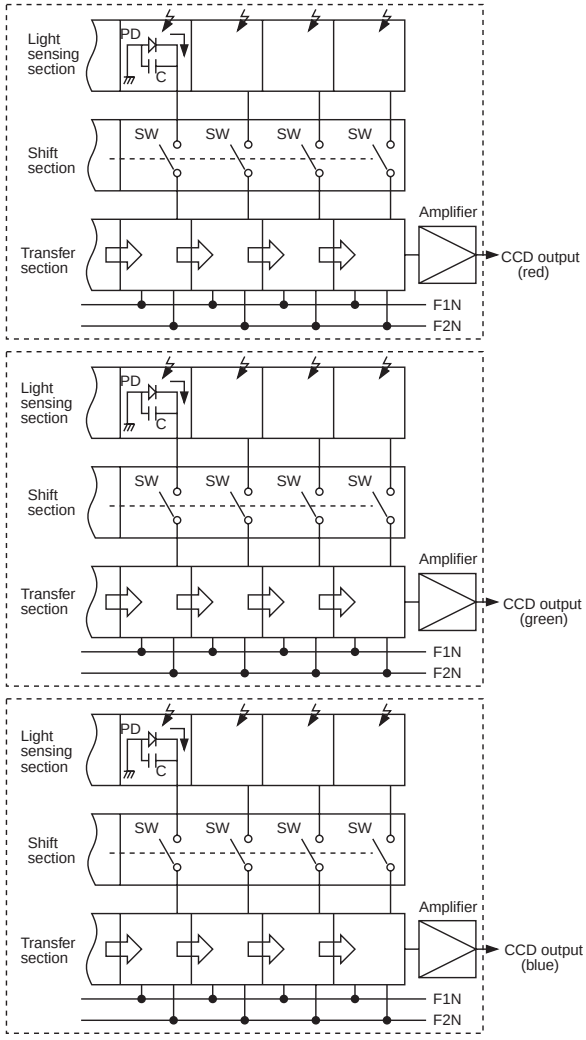

Fig. 2-12

The analog image signals output from CCD are subjected to offset adjustment and analog gain processing in the subsequent analog IC.

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Block diagram

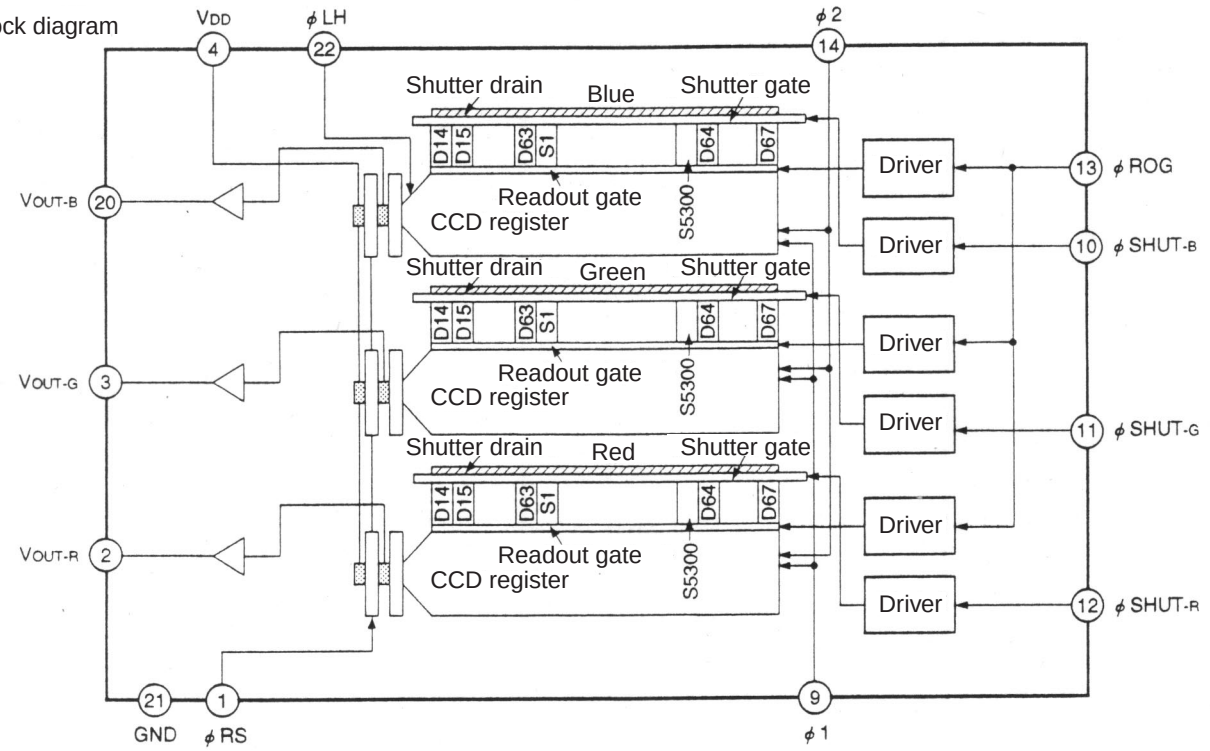

Fig. 2-13

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4) A/D conversion

The image signals (analog signals) corrected in the analog IC are converted into 14-bit image data (output after divided into lower 8 bits and higher 6 bits) by the A/D converter in the following order; red image signal, green image signal and blue image signal.

A voltage of +5 V is applied to the VRT terminal of A/D converter. The A/D converter outputs "16383" for an input signal of +3.5 V, and "0" for +1.5 V.

Through this process, signals of 1 pixel are converted into image data that has 16384 gradations in each of red, green and blue.

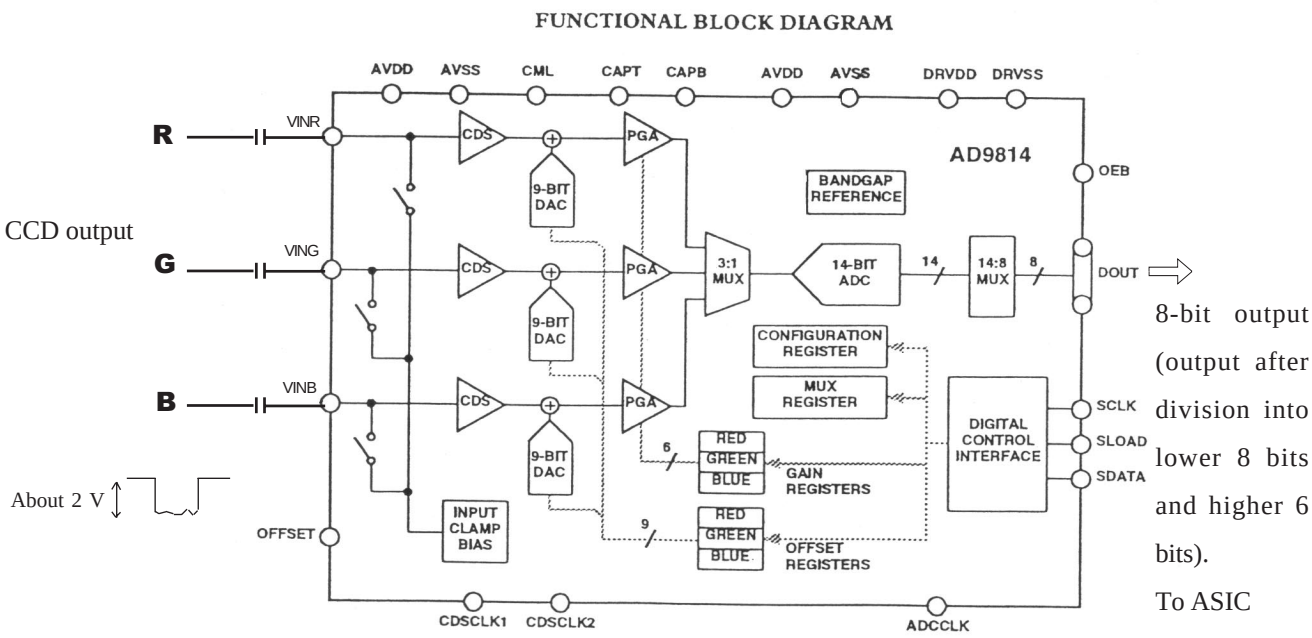

Fig. 2-14

5) Digital clamp

Digital clamp refers to a processing for digitally adjusting the offset level which has changed due to influence by smear, etc.

Concretely, a digital image obtained with an A/D converter contains the image information about an optical light-shielded area called "optical black area" for each line. Its level must remain unchanged at the value in the afore-mentioned analog offset adjustment primarily. However, it changes slightly due to influence by smear, etc. A slight change will cause an image deterioration such as lateral stripes. Therefore, such a change needs to be minimized. For suppressing the change of offset, this scanner takes a difference between the primary target offset level and the average level of optical light-shielded area, and adds it to the image area.

In regular scan, however, an image deterioration often called "vertical stripes" may occur due to over-damping, so offset level is adjusted for not each line but each image.

6) Black shading correction

As is known, a CCD more or less involves an offset unevenness for each pixel. This offset unevenness causes an image degradation such as lateral stripes.

So, this scanner reduces output unevenness of each pixel in the following way. An image is scanned with no light incident on CCD and the minimum output level of each pixel is stored in memory. Then, that level is subtracted during image scan.

7) White shading correction

Black shading correction is an offset level adjustment of each pixel. In contrast, white shading correction is a photoelectric conversion output sensitivity adjustment of each pixel.

The possible causes of uneven photoelectric conversion output sensitivity for each pixel are listed below.

1. Light quantity of the lamp or LED is uneven.
2. Light quantity is uneven between the center and circumference due to lens.
3. Sensitivity is uneven due to each CCD pixel.
4. Light quantity is uneven due to dust, etc. on CCD surface.

To solve this problem, this scanner stores the output level in the completely open status (in which there are no light blocking substances such as film) and digitally correct gain of the image corresponding to the pixels whose sensitivity was low in image scan.

8) Gamma correction

The image data after white shading correction is the one in which each of red, green and blue image data is evenly divided into 65536 steps of film density.

It is the gamma correction that adjusts the gradation (contrast) and density of this image data.

This scanner is capable of automatically and manually correcting each base color of both positive and negative films.

a) Automatic base color correction

The base color and density of film vary with film maker, photographing conditions and storage state. Automatic base color correction is a means of reading images stable in color balance automatically irrespective of kind and state of a film.

In this scanner, film information is read as a thumbnail image and from this image, optimum reading conditions (reading speed and gamma curve) are automatically set for the correction.

In case of an over-exposure negative film, reading speed is slowed and gamma curve is generated so as to optimize density.

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b) Manual correction

For an image after automatic base color correction, manual base color adjustment is allowed.

Changeable items are :

1. User tone curve
2. Brightness
3. Contrast
4. White and black spots
5. Monitor gamma

9) Masking

The masking section is a circuit for correcting the transmission characteristics of the B, G and R filters in CCD. It is ideal that each filter transmits only the light in the determined wavelength region and blocks the light of other wavelength. Actually, however, the filter partially transmits the light at an unnecessary wavelength and blocks the light at the necessary wavelength.

In order to correct the actual characteristic and thereby bringing it close to the ideal one, the read image signals are subjected to the following calculations.

$$\begin{pmatrix} R_{out} \\ G_{out} \\ B_{out} \end{pmatrix} = \begin{pmatrix} R_r & G_r & B_r \\ R_g & G_g & B_g \\ R_b & G_b & B_b \end{pmatrix} \begin{pmatrix} R_{in} \\ G_{in} \\ B_{in} \end{pmatrix}$$

Rin, Gin, Bin : Input signals to color correction circuit block

Rout, Gout, Bout : Output signals from color correction circuit block

Rr, Gr, Br : Correction factors of R filter

Rg, Gg, Bg : Correction factors of G filter

Rb, Gb, Bb : Correction factors of B filter

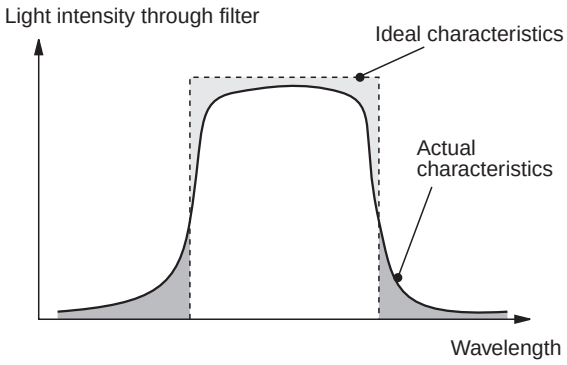

Fig. 2-15

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10) Color data synthesis

In the 3-line CCD, the CCDs for reading red, green and blue are laid in parallel with one another in the carriage moving direction. Therefore, they do not read the red, green and blue image data on the same line simultaneously. Instead, they read the data on different lines with a clearance of a few lines.

So, this scanner saves each image data in the RAM on PC once and processes it as the color data from 1 line when all the image data has been obtained on the same line.

11) Enlargement and reduction

This scanner has 4 basic resolutions ; 4000 dpi, 2000 dpi, 1000 dpi and 500 dpi. If any reading resolution other than the basic ones is set, an image of the target resolution is to be generated by enlargement or reduction.

Shown below is the relationship between the basic resolutions and specified ones.

Specified resolution	Basic resolution
2001 dpi or more	4000dpi
1001dpi ~ 2000dpi	2000dpi
501dpi ~ 1000dpi	1000dpi
500 dpi or less	500dpi

Table 2-2

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12) Dust/scratch correction function

CanoScan FS4000US incorporates a function for detecting dust on a film, its scratch, etc. and for their correction (FARE; Film Automatic Retouching and Enhancement). This function is outlined below.

When illuminating a developed film with visible light, an image is formed as the light is transmitted or blocked due to the emulsion layer remaining on film base (as shown in Fig. 2-17).

However, the emulsion layer cannot block infrared light. Therefore, when illuminating a film with infrared light source, only dust and scratch on the film are obtainable as black patterns (in case of positive film). (See Fig. 2-17.)

By binary-coding this image information with a certain threshold set, each position of the dust and scratch on the film can be determined (detected).

Next, according to visible light image information about the vicinity of dust and scratch, the image at the dust/scratch position is presumed for correction. Although there are various correction methods available, an appropriate one is selected depending on the size and width of dust/scratch or information about the circumferential image (as to whether image is uniform or fine patterns), etc. so that dust and scratch are least conspicuous. In addition, the threshold used in dust and scratch detection is varied in response to the exposure condition and color information of an image so as to detect dust and scratch exactly.

In order to realize such an algorithm as above, the CanoScan FS4000US uses its mercury cold cathode fluorescent tube as a film illuminating visible light source and its IRED as a film illuminating infrared light source, which are changed over appropriately by the CPU circuit for film illumination. (See Fig. 2-16.)

Also, for an efficient acquisition of image data, a visible light image is acquired while the carriage advances, and an infrared light image is acquired while the carriage reverses. Since images are acquired through such a reciprocal motion, an algorithm for matching the positions of visible and infrared light images is used to correct a mechanical positional error of a few pixels. Further, a deviation in focus position due to different illumination wavelengths is corrected by driving the AF motor in each image acquisition.

Although the FARE function is outlined above, neither dust nor scratch can be detected on a film such as Kodachrome whose emulsion layer blocks infrared light as well. Therefore, correction is invalid for such a film.

In case of a monochrome film, infrared light is blocked and dispersed by the silver particles in emulsion layer, so this correction is ineffective.

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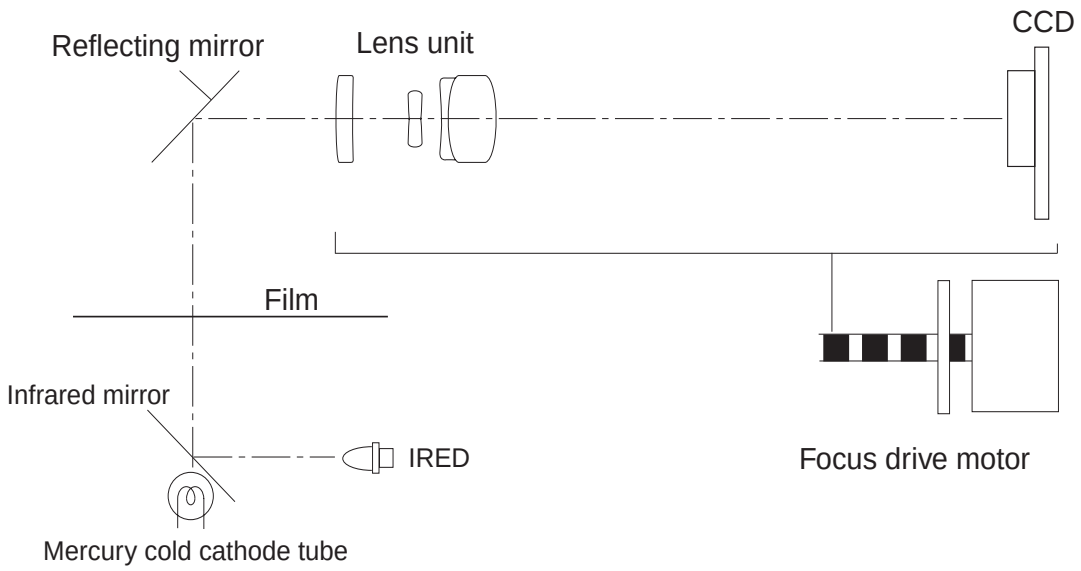

Fig. 2-16

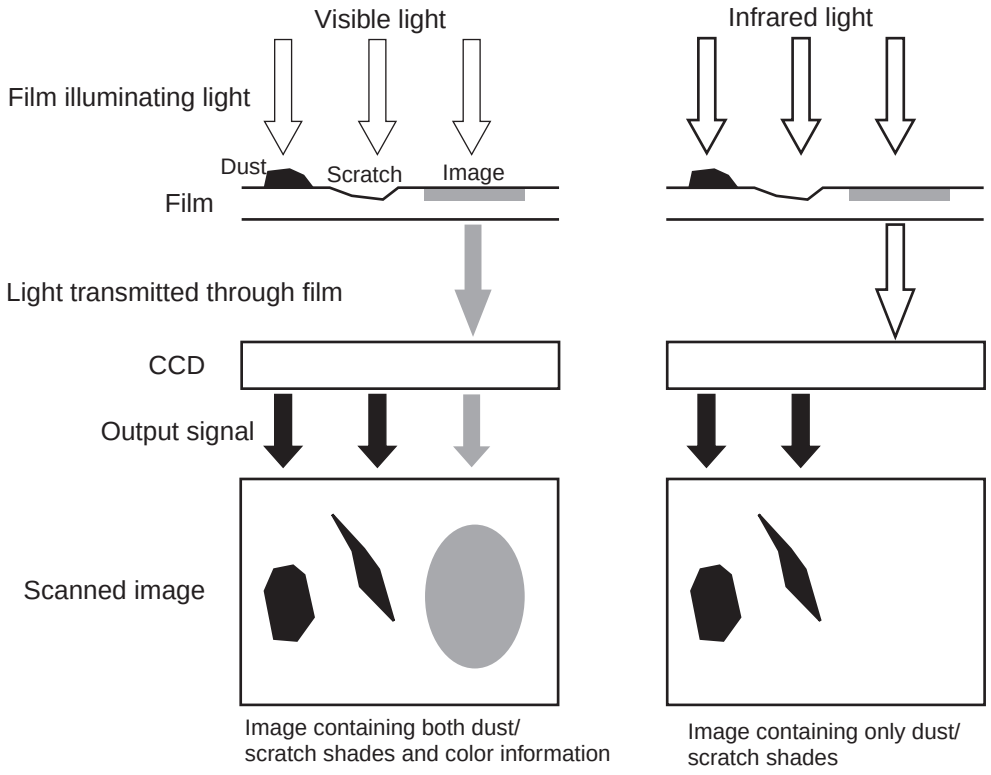

Fig. 2-17

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IV CONTROL BLOCK

A. Interface

1. SCSI (Small Computer System Interface)

The scanner and external equipment are connected via SCSI.

SCSI indicates the specifications of a general-purpose input/output interface between a personal computer and peripheral equipment.

The SCSI adopted for this scanner features as follows.

- Up to 8 equipments that have an SCSI interfacecan be connected on an SCSI bus.

Reference : SCSI bus refers to a signal line formed by connecting the equipments which have an SCSI interface.

- Data can be exchanged between peripheral equipments without a host computer in between.
- Data transmission speed is max. 10M bytes/sec (in synchronous transmission).
- Cable length is 6 m max. (in case of unbalanced type). Usually, a 50-pin connector is used.
- Protocol (communication rules) is regulated.
- There are commands which can be shared between the host computer and peripheral equipment.

SCSI has two transmission modes ; synchronous and asynchronous. In this scanner, a suitable transmission mode is set by the host computer.

In addition, SCSI has two signal modes ; balanced and unbalanced. This scanner has adopted the unbalanced signal mode.

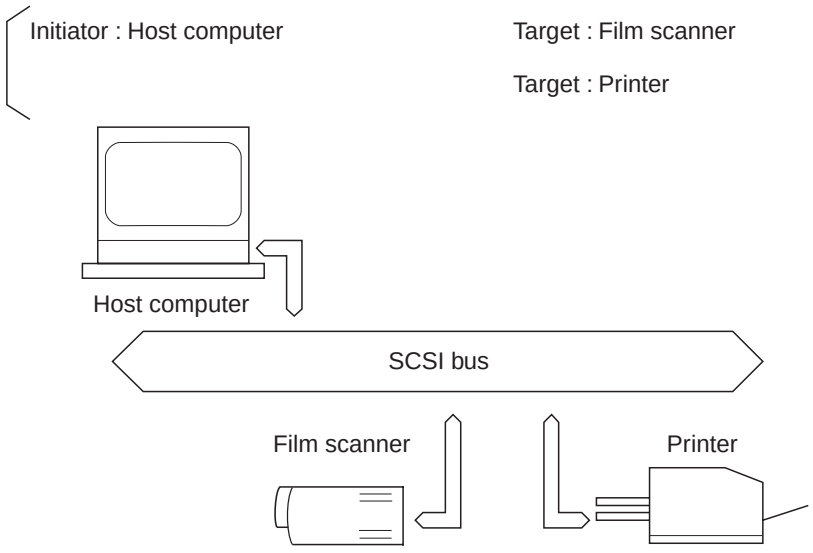

Fig. 2-18

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The unbalanced mode is a signal mode in which open collector output is dependent on negative logic (“L” = 1 = true, “H” = 0 = false).

Each SCSI equipment works as an initiator or target, and a series of operations are performed between 2 equipments; initiator and target.

Initiator refers to an SCSI equipment which requests other equipment connected on a bus to perform an operation.

Target refers to an SCSI equipment which executes an operation requested by the initiator.

As mentioned above, up to 8 equipments that have an SCSI interface can be connected on an SCSI bus. Each SCSI equipment on this bus has its own identification number called SCSI-ID.

This ID number is assigned responding to each bit of data bus.

ID#7 to ID#0 correspond to DB7 to DB0, respectively.

SCSI equipments identify one another by the SCSI-ID numbers. On the right to use the SCSI bus, priority is determined in ID numbers. (This scanner can change its ID number by altering the dial value of SCSI ID selector.) Namely, ID#7 is at the highest rank and ID#0 is at the lowest rank.

SCSI also has disconnecting and reconnecting functions, whereby multiple controllers or multiple peripheral equipments connected to the same controller are allowed to do simultaneous parallel processing on the SCSI bus.

Note : The disconnecting function is for enabling a target to disconnect its initiator, thereby opening the bus.
The reconnecting function is for allowing a target to request reconnection with the bus for its initiator.

When the bus is opened by the disconnecting function while a target executes a command sent from its initiator, other equipments can use the bus, so parallel processing is possible.

After its processing, the target can reconnect itself to the bus by the reconnecting function as required.

Note : In the SCSI interface adopted for this scanner, the latter is always used as a target and will not become an initiator. In other words, its initiator is always external equipment (host computer).

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2. SCSI bus phase

For controlling the operation of SCSI equipment, bus phases (bus statuses) are regulated in SCSI.

Note : Bus phase indicates in what status a bus is used.

An SCSI bus operates through a transition among the eight phases detailed below.

Two or more bus phases will not be assumed simultaneously.

Bus Free Phase

In this status, none of the SCSI equipments are using the bus.

Arbitration Phase

In this phase, SCSI equipments attempt to acquire the right to use the bus.

After confirming the bus free phase, each SCSI equipment turns BSY signal to “L” and outputs its own ID number, thereby entering the arbitration phase. At this time, other SCSI equipments can enter the arbitration phase.

Then, the SCSI equipment having the ID number of the highest rank will obtain the right to use the bus.

Selection Phase

This phase is used for the initiator, which has obtained the right to use the bus, to select the SCSI equipment to be operated as a target.

Reselection Phase

In this phase, a target selects its initiator for target reconnection with the bus.

Command Phase

In this phase, a target receives a command from its initiator.

Data Phase

This phase is provided for data exchange between target and initiator.

Data transmission from the initiator to a target is called “data out” and that from a target to its initiator is called “data in” .

Status Phase

This phase is used for a target to notify the initiator of the result of command execution (status). In other words, this phase is used for status transmission from a target to the initiator.

Message Phase

In this phase, information other than command data status is exchanged between a target and its initiator.

Message transmission from the initiator to a target is called “message out” and that from a target to its initiator is called “message in” .

The above-mentioned command phase, data phase, status phase and message phases are collectively called “information transmission phase” .

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3. SCSI bus phase sequence

The basic sequence of the bus phases is shown in Fig. 2-19.

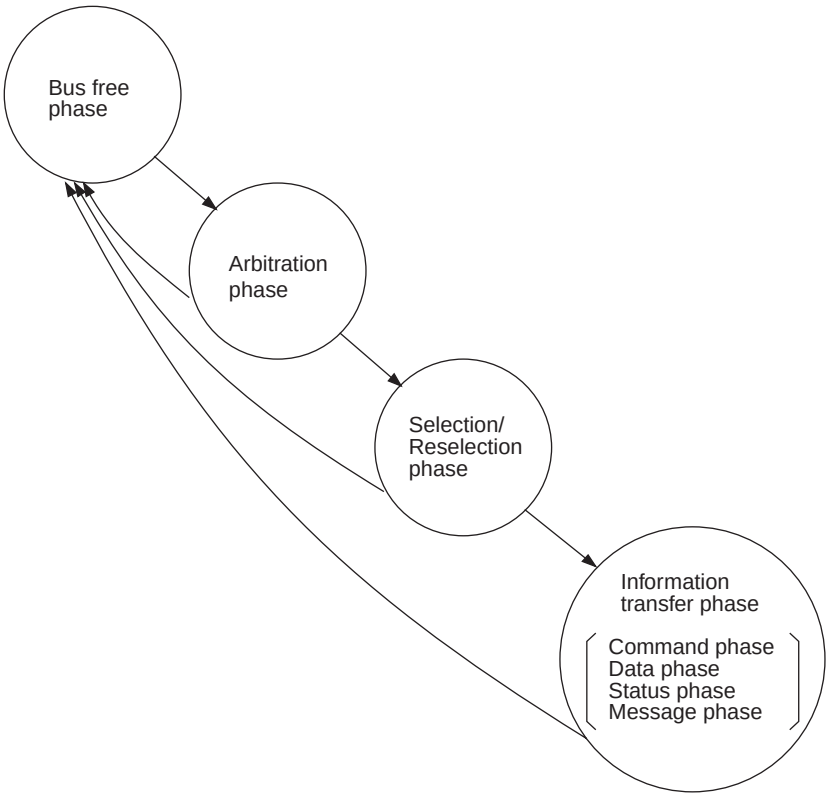

Fig. 2-19

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4. Interface signals

Fig. 2-20 shows the interface signals for connecting the scanner and external SCSI equipment.

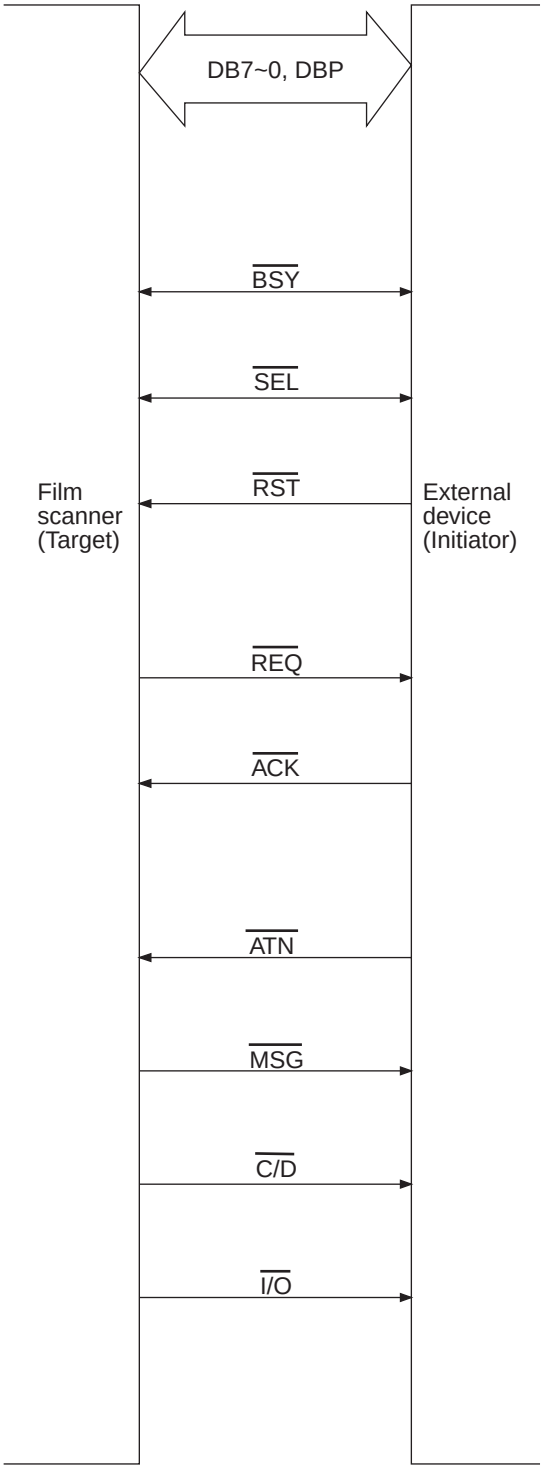

Fig. 2-20

Each interface signal is explained below.

DB7~0,DBP

(DATA BUS PARITY-ODD)

This is a bidirectional data bus consisting of 9 signal lines for sending/receiving 1-byte data and an odd-parity bit.

The initiator sends commands to the target (scanner) via the data bus, and the target sends various data and statuses to the initiator via the data bus.

BSY (BUSY)

This signal indicates that the SCSI bus is being used.

In the arbitration phase, this signal indicates a request for the right to use the bus.

SE (SELECT)

This signal is used for the initiator to select the target or the target to reselect the initiator.

In the arbitration phase, this signal indicates a success in acquisition of the right to use the bus.

RST (RESET)

This is a reset signal effective for all SCSI equipments on the bus.

REQ (REQUEST)

This is an information transfer request signal from the target to initiator in the information transmission phase.

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ACK (ACKNOWLEDGE)

This is an acknowledgment signal from the initiator to target in response to REQ signal.

ATN (ATTENTION)

This signal indicates that the initiator has a message to be sent to the target.

MSG, C/D, I/O

A combination of these signals specifies the kind of the information transmission phase for execution by the target, and information transmitting direction.

Table 2-3 lists the relationship between these signals and information transmission phase.

MSG (MESSAGE)

This is a signal to be output for indicating that the target is in the message phase.

C/D (CONTROL/DATA)

This signal indicates which signal is output on the bus by the target, control data (command, status or message) or the data to be transmitted.

When C/D = “L” , the output signal is control data.

When C/D = “H” , the output signal is the data to be transmitted.

I/O (INPUT/OUTPUT)

This signal is output by the target to indicate the signal direction on the bus.

Information is transmitted from the target to initiator when I/O = “L” and from the initiator to target when I/O = “H” .

This signal is also used for distinguishing the selection phase and reselection phase from each other.

I/O= “L” : Reselection phase

I/O= “H” : Selection phase

Kind of phase	C/D	I/O	MSG	DB7~0	Transmission direction
Command phase	"L"	"H"	"H"	Command	INIT→TARG
Data-in phase	"H"	"L"	"H"	Data	INIT←TARG
Data-out phase	"H"	"H"	"H"	Data	INIT→TARG
Status phase	"L"	"L"	"H"	Status	INIT←TARG
Message-in phase	"L"	"L"	"L"	Message	INIT←TARG
Message-out phase	"L"	"H"	"L"	Message	INIT→TARG

Table 2-3 Kinds of Information Transfer Phase

Note : INIT and TARG represent initiator and target, respectively.

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5. Pin map of interface connector

The SCSI connector used in this scanner of a 50-pin sealed type connector and its pin map is shown in Table 2-4.

Pin	Signal name	Pin	Signal name
01	GND	26	DB0
02	GND	27	DB1
03	GND	28	DB2
04	GND	29	DB3
05	GND	30	DB4
06	GND	31	DB5
07	GND	32	DB6
08	GND	33	DB7
09	GND	34	DBP
10	(OPEN)	35	(OPEN)
11	GND	36	(OPEN)
12	(OPEN)	37	(OPEN)
13	(OPEN)	38	TERMPWR
14	(OPEN)	39	(OPEN)
15	(OPEN)	40	(OPEN)
16	GND	41	ATN
17	(OPEN)	42	(OPEN)
18	GND	43	BSY
19	GND	44	ACK
20	GND	45	RST
21	GND	46	MSG
22	GND	47	SEL
23	GND	48	C/D
24	GND	49	REQ
25	GND	50	I/O

Table 2-4 Pin Map of 50-pin Connector

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6. USB (Universal Serial Bus)

USB is a comparatively new industry standard for connecting various peripheral equipments and computer.

USB allows a high speed data exchange as high as 12 Mbps per second and its cable can be plugged in and unplugged without turning off the power supply of the computer (hot plug feature). There is no need for equipment setting due to connection (plug & play feature) and a single computer can use multiple equipments simultaneously.

USB Port and Connector

USB port and connector are available in two types ; A and B. The port and connector of type A have a small oblong shape. They are basically used for connecting equipment to the type-A USB port of a computer or hub. The port and connector of type A are sometimes called “downstream type” This is because the port and connector of type A are used for flowing data from a computer or peripheral equipment.

The port and connector of type B have a small square shape and are used for connecting a USB cable to USB equipment. The port and connector of type B are sometimes called “upstream type” This is because the port and connector of type B are used for flowing data from peripheral equipment to a computer or USB hub.

USB Hub

USB hub has two types ; self-power and bus power types.

Self-power type hub

For a hub of this type, power can be supplied to the hub externally using an AC adapter. When using a hub of this type, the cord of AC adapter needs to be connected to a receptacle or power tap. Because a hub of this type can supply the power obtained from an external power source to other equipment, multiple USB equipments are connectable normally. A self-power type hub is usually provided with 4 USB ports.

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Bus power type hub

A hub of this type obtains power from other equipment (such as computer). Other USB equipment can also be connected to a hub of this type. However, this hub alone cannot supply adequate power to equipment that consumes large power (such as printer). For using this type, special software need not be installed. This is because the sole function of this hub is to transmit information from other USB equipment simply to a computer.

In the USB specifications, it is not allowed to connect another bus power type hub to a bus power type hub.

If connected, adequate power will not be supplied to the second hub. For connection of hubs, at least one hub must be the self-power type.

USB equipments and hubs can be hierarchically connected by connecting hubs. A hierarchy of up to 6 levels can be configured. The upper limit of connectable equipments is 127 units as a total of USB equipments and hubs.

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V POWER SUPPLY

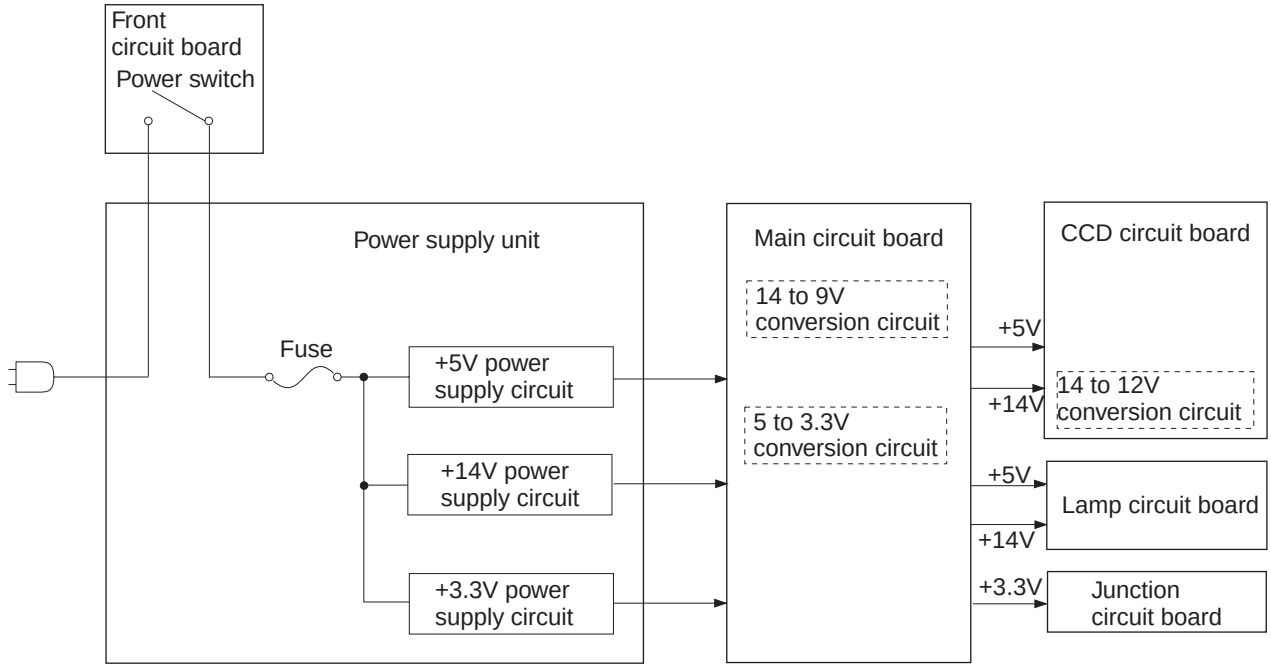

Fig. 2-21

When turning on the power switch on the front of scanner, AC power is supplied to the power supply unit.

The power supply unit incorporates 3 kinds of DC power supply circuits (+3.3 V, +5 V, +14 V). And the CPU (main) circuit board incorporates 14 to 9 V and 5 to 3.3 V conversion circuits, and the CCD circuit comprises a 14 to 12 V conversion circuit.

+3.3, 5 and 9 V supplies are used for ICs, etc. on the CU circuit board and sensors, while +14 V supply is used for turning on the film illumination lamp. The 3.3 V line in the power supply unit is used exclusively for the motor power supply of APS adapter.

Each DC power supply circuit has an overload protection circuit for turning off the output voltage automatically if a trouble such as short-circuit occurs on the load side. Therefore, if no voltage is output from the power supply circuit, the power switch must be turned off once, and then turned it on again after eliminating the cause of trouble.

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CHAPTER 3

MECHANICAL SYSTEM

This chapter concerns mechanical features and actions, and disassembly and reassembly procedures.
When disassembling or reassembling the machine, observe the following points.

1. Be sure to disengage the power plug to ensure safety before disassembling or reassembling the electrical and mechanical systems having different functions as stated in the chapter.
2. Unless otherwise specified, for reassembly, proceed in the reverse of disassembly.
3. Do not mistake the types (length, diameter) and locations of screws, etc.
4. Be sure to use toothed washers when mounting the top cover for ensuring the electrical continuity.
5. Do not try to operate the machine with any part removed, as a rule.

I. EXTERIOR 3-1
A. External covers 3-1
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A. Scanner unit 3-4
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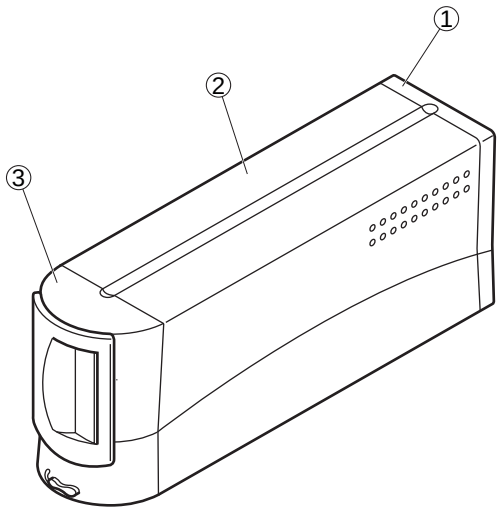
Note : The machine uses, besides screws having 3 mm of nominal diameter, ones having 2 mm. For loosening or tightening the latter, use a precision screwdriver. Also, do not break nor lose them.

I EXTERIOR

Before cleaning, checking or repairing the machine interior, remove the covers, if so required, in the following procedure.

Note that the description will be omitted for covers which can simply and singly be removed just by loosening their screws.

A. External covers



① Rear cover

② Top cover

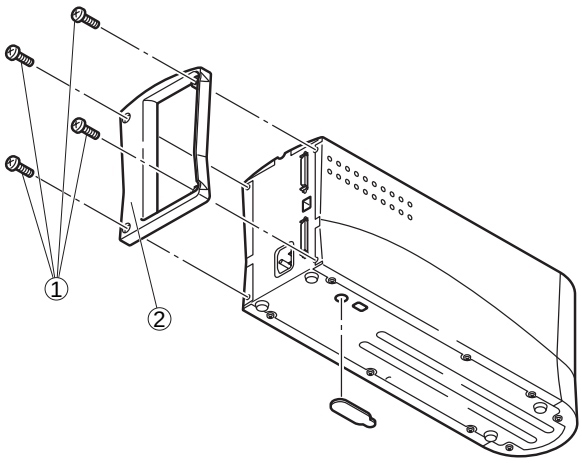
③ Front cover unit

Fig. 3-1

1. Rear cover

1) Loosen 4 screws **a** from the rear cover.

2) Remove the rear cover.



① Screw **a**

② Rear cover

Fig. 3-2

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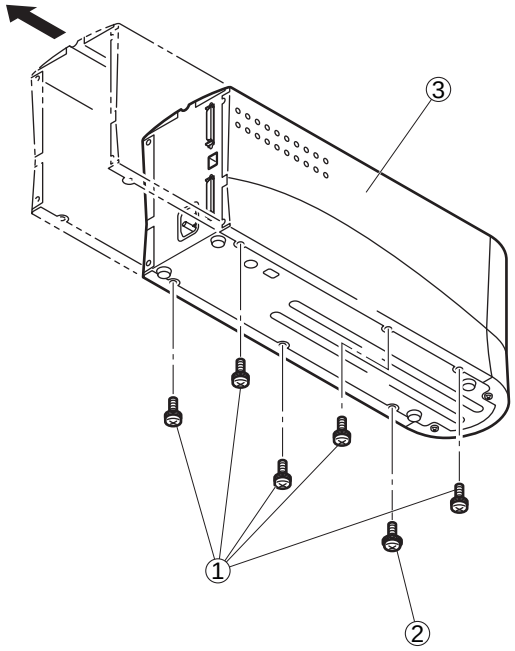
2.Top cover

1) Remove the rear cover.
2) Loosen 5 screws **a** and 1 screw **b** from the bottom of top cover.
3) Slide in the arrow direction and then remove the top cover.



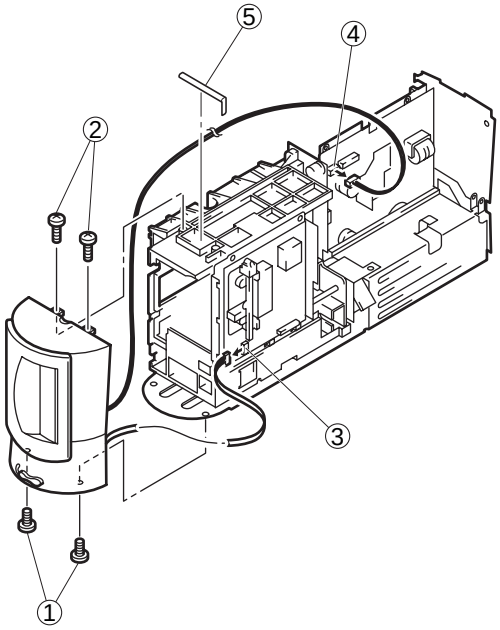
① Screw **a**
② Screw **b**
③ Top cover

Fig. 3-3

Note : When mounting the top cover, do not pinch the internal cords, etc.
Do not pinch the gasket on the top of scanner between the top cover and front cover.

3.Front cover unit

1) Remove the rear cover.
2) Remove the top cover.
3) Disengage the connectors CN52 and CN3.
4) Loosen 2 screws **a** from the bottom of front cover.
5) Peel the gasket from the top of scanner, and loosen 2 screws **b** from the top of front cover.
6) Remove the front cover unit.



① Screw **a**
② Screw **b**
③ Connector CN52
④ Connector CN3
⑤ Gasket

Fig. 3-4

Note : A spare front cover unit contains no leaf spring. When replacing the front cover unit, transfer the leaf spring without fail. (For location of the leaf spring, see Fig. 3-5 on next page.)

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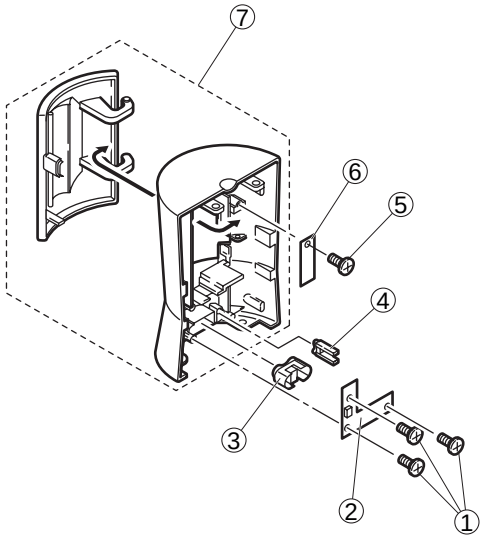
4.Disassembling the front cover unit

Note : The power switch button and LED window are held by the front circuit board. Do not lose them when removing the front circuit board.

1) Loosen 3 screws **a** from the front circuit board.
2) Remove the front circuit board.
3) Remove the power switch button.
4) Remove the LED window.
5) Loosen screw **b**.
6) Remove the leaf spring.

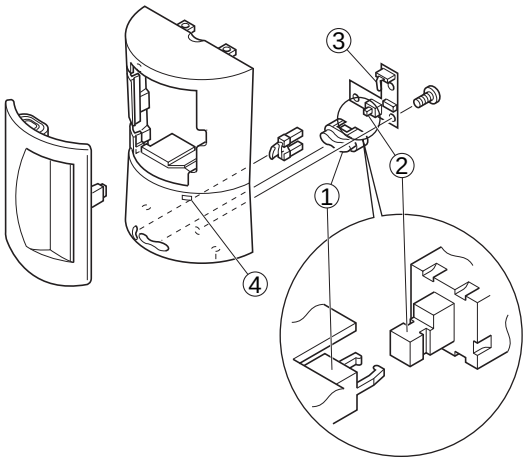


① Screw **a**
② Front circuit board
③ Power switch button
④ LED window
⑤ Screw **b**
⑥ Leaf spring
⑦ Front cover unit

Fig. 3-5

Note : Tighten the screws on the front circuit board only after confirming the following.

- The power switch button and power switch are engaged.
- The micro switch detecting lever is in the small window of the front cover.



① Engaging section of power switch button
② Engaging section of power switch
③ Detecting lever of micro switch
④ Small window of front cover

Fig. 3-6

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II SCANNER UNIT

A. Scanner unit

Note : After replacing the scanner unit, different characteristics recorded in EEPROM must be changed. From the data sheet packed together with the scanner unit, write the following data.

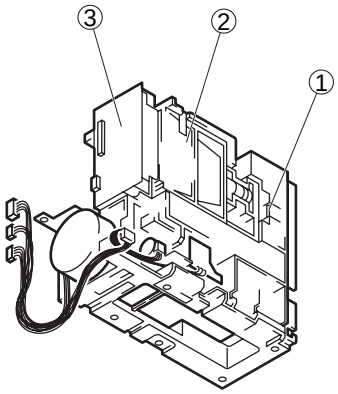
- Film holder HP
- Film carriage HP
- AF position

Also, carry out electrical adjustment referring to Chapter 6, G.

Note : Do not remove the optics. When removing or mounting the scanner unit, never touch the optics.

Do not disassemble the scanner unit but replace only the following parts which can be removed from outside.

- Carriage drive motor
- Focus drive motor
- AF nut
- AF-PI circuit board



① Mirror
② Focus unit
③ CCD circuit board
— Optics

Fig. 3-7

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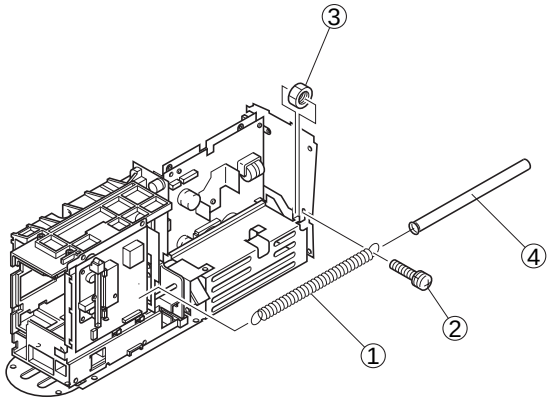
1.Removing the scanner unit

1) Remove the rear cover.
2) Remove the top cover.
3) Remove the front cover.

Note : Remove the carriage spring carefully because it is extended.

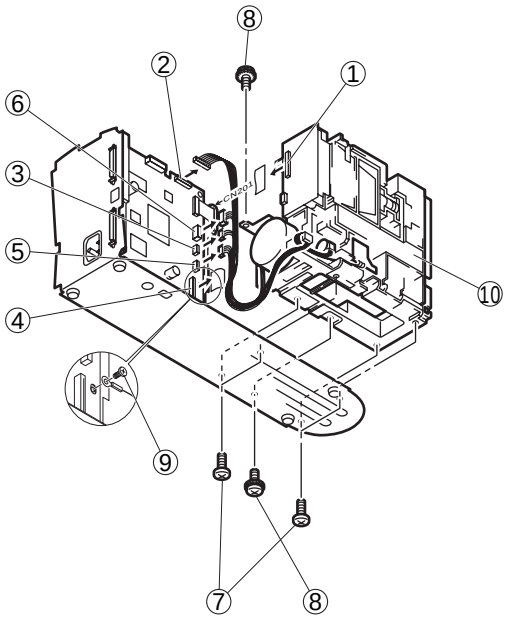
4) Loosen screw **a** holding the carriage spring until freed.
5) Paying attention so that the spring will not come off abruptly, pull out screw **a**, and remove the nut, spring and protective tube.



① Carriage spring
② Screw **a**
③ Nut
④ Protective tube

Fig. 3-8

6) Disengage 6 connectors (CN1, CN101, CN104, CN302, CN303, CN305).
7) Loosen screw **d**, and detach the ground wire from the CCD circuit board.
8) Loosen 4 screws **b** and 1 screw **c** from the bottom of base plate.
9) Loosen 1 screw **c** from the top of base plate.
10) Remove the scanner unit.



① CN1 (main circuit board, CN201)
② CN101 (lamp circuit board, CN51)
③ CN104 (AF-PI circuit board)
④ CN302 (junction circuit board, CN72)
⑤ CN303 (Focus drive motor)
⑥ CN305 (carriage drive motor)
⑦ Screw **b**
⑧ Screw **c**
⑨ Screw **d**
⑩ Scanner unit

Fig. 3-9

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2. Mounting the carriage spring

1) Pass a lead of about 50 cm long (26-28 gauge) through the loop of carriage spring (Fig. 3-10a).
2) Fit both ends of the lead, and pass the ends through the protective tube from the larger opening to the smaller opening (Fig. 3-10b).
3) Pull the ends of lead until the loop of carriage spring comes out of the smaller opening of the protective tube (Fig. 3-10c).

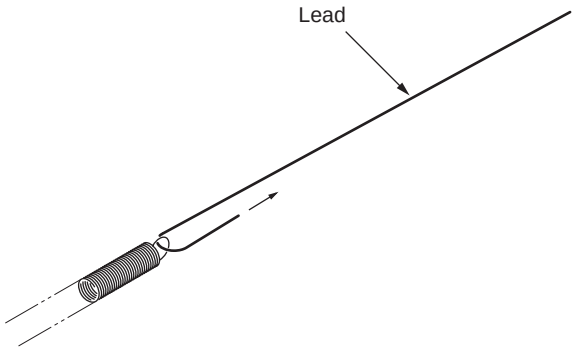

Fig. 3-10a

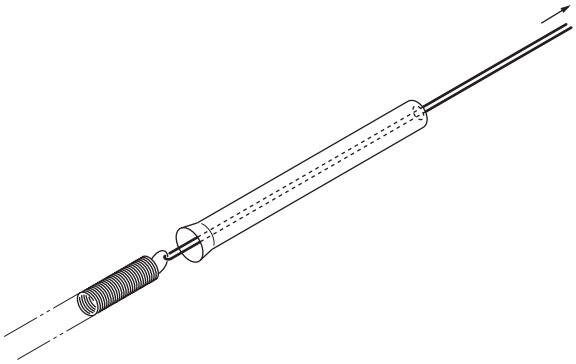

Fig. 3-10b

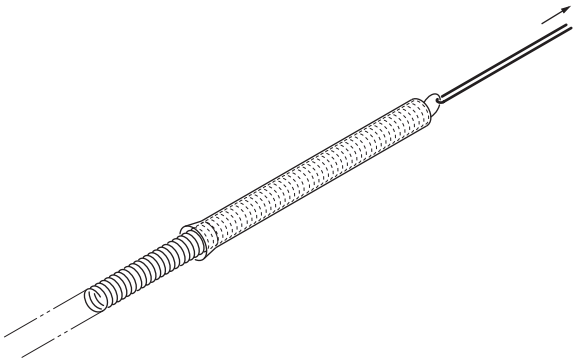

Fig. 3-10c

4) Using fine pincers, hold the neck of carriage spring loop, and position the loop on the mounting screw hole (Fig. 3-10d).
5) Fasten the spring by screw **a**. (See Fig. 3-8.)

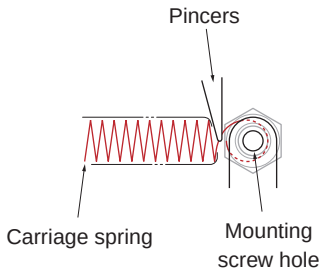

Fig. 3-10d

Note : Do not deform the protective tube. Before replacing the protective tube with a new one, shape it as shown in Fig. 3-11 by hair dryer.

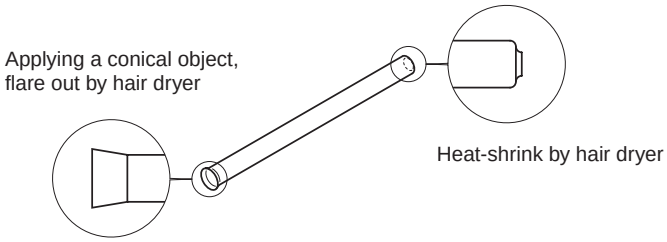

Fig. 3-11

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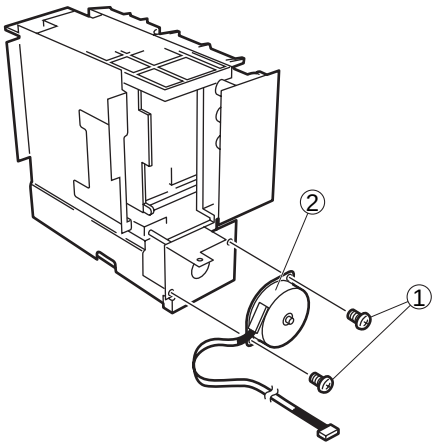
3. Removing the carriage drive motor

1) Remove the rear cover.
2) Remove the top cover.
3) Remove the front cover.
4) Remove the scanner unit.
5) Loosen 2 screws **a**.
6) Remove the carriage drive motor.



① Screw **a**
② Carriage drive motor

Fig. 3-12

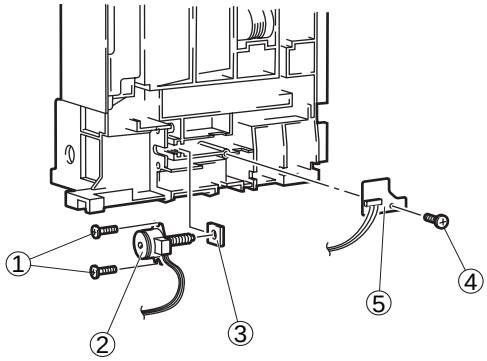
Note : Mount the carriage drive motor carefully so as not to dent the mating drive shaft gear.

4. Removing the focus drive motor

1) Remove the rear cover.
2) Remove the top cover.
3) Disengage CN303.
4) Loosen 2 screws **a**.
5) Remove the focus drive motor.
6) Loosen AF nut.

5. Removing the AF-PI circuit board

1) Remove the rear cover.
2) Remove the top cover.
3) Disengage CN104.
4) Loosen screw **b**.
5) Remove the AF-PI circuit board.



① Screw **a**
② Focus drive motor
③ AF nut
④ Screw **b**
⑤ AF-PI circuit board

Fig. 3-13

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III CIRCUIT BOARDS

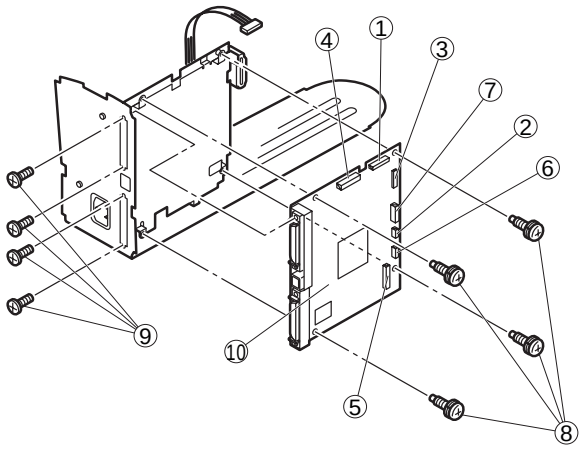
Note : The main circuit board alone will not be supplied as a service part. A combination of the main circuit board and the scanner unit, i.e., “the main PCB W/scanner ass'y” is available instead.

When replacing the main circuit board, it is therefore required to replace the scanner unit also. In this case, electrical adjustment may not be necessary.

For how to replace the scanner unit, refer to Section II - Scanner Unit, p. 3-4.

A. Main circuit board unit

1) Remove the rear cover.
2) Remove the top cover.
3) Disengage 7 connectors (CN101, CN104, CN201, CN301, CN302, CN303, CN305).
4) Loosen 4 screws **a**.
5) Loosen 4 screws **b**.
6) Remove the main circuit board unit.



① CN101 (lamp circuit board, CN51)
② CN104 (AF-PI circuit board)
③ CN201 (CCD circuit board, CN1)
④ CN301 (power circuit board)
⑤ CN302 (junction circuit board, CN72)
⑥ CN303 (focus drive motor)
⑦ CN305 (carriage drive motor)
⑧ Screw **a**
⑨ Screw **b**
⑩ Main circuit board

Fig. 3-14

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B. Power unit

1) Remove the rear cover.

2) Remove the top cover.

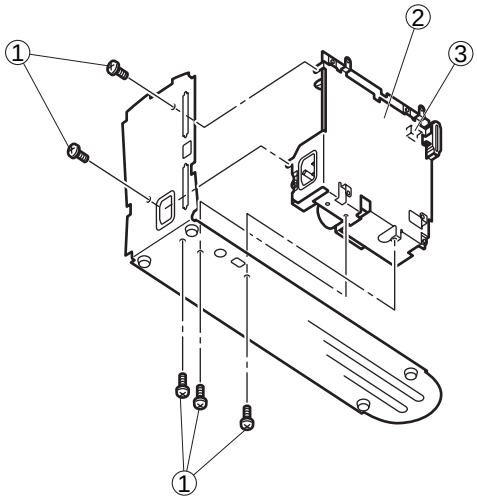
3) Disengage connector CN3.

4) Remove the main circuit board unit.

5) Loosen 2 screws **a** from the rear.

6) Loosen 3 screws **a** from the bottom.

7) Remove the power unit.



① Screw **a**

② Power unit

③ CN3

Fig. 3-15

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IV CABLES CONNECTION

A. How to connect cables

1) Pass the ground wire from the CCD circuit board under the arm, and fasten its lug together with the main circuit board.
2) The lead from the lamp circuit board must be passed under the arm and on the heat sink of IC305, and engaged with the main circuit board.
3) Engage the connectors from the AF motor and AF-PI circuit board with the main circuit board and, so as to minimize the slackness, wind the leads 1 turn on the arm. Eliminate any slackness of the leads by bending it in the form of inverted U.
4) Engage the carriage drive motor connector with the main circuit board, and wind the leads 1 turn on the arm.
5) Engage the flat cable from the carriage with the main circuit board.
6) The leads from the front cover must be wound by 2 turns on the arm so as to minimize their slackness, passed under the leads of carriage drive motor, leads interconnecting the lamp and main circuit boards, and leads interconnecting the main circuit board and power circuit board, and engaged with the power circuit board.

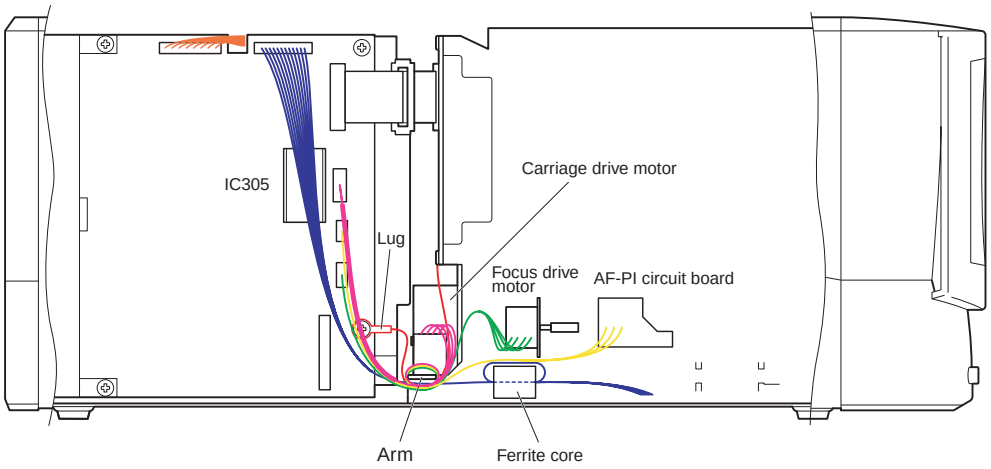

Fig. 3-16a (Step 1 to 4)

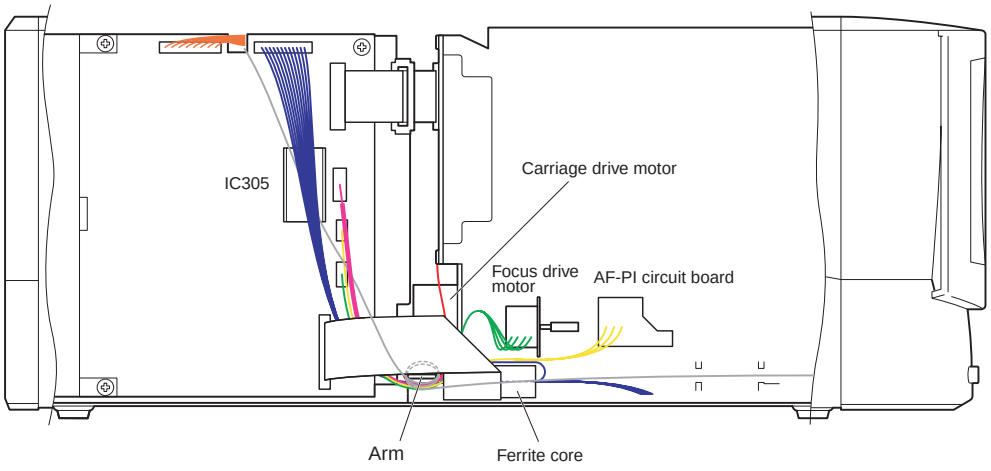

Fig. 3-16b (Step 5 and 6)

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B. Photos of mainframe interior

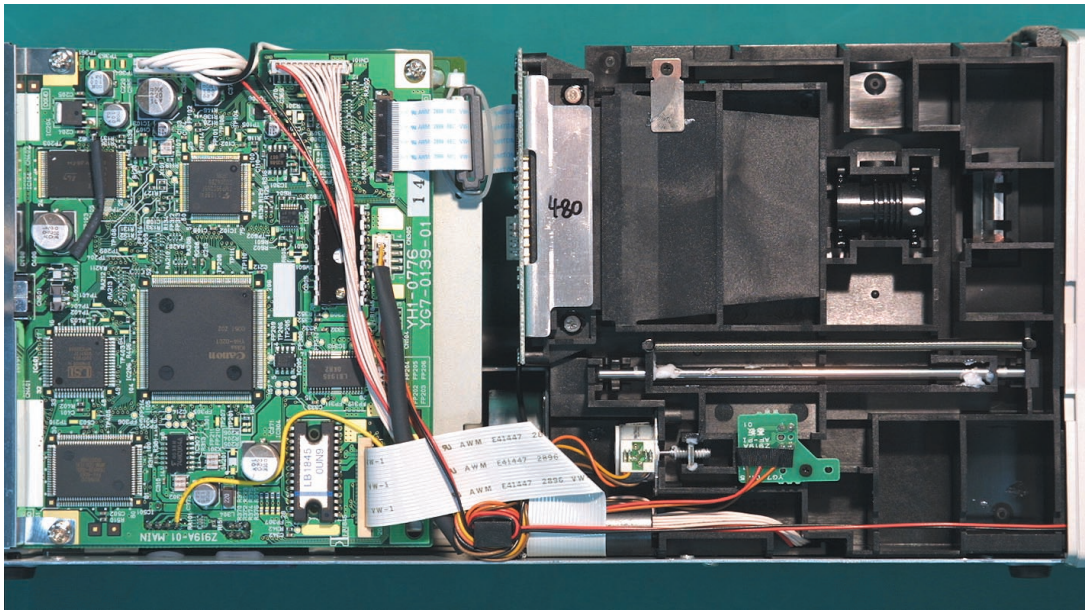

Fig. 3-17a

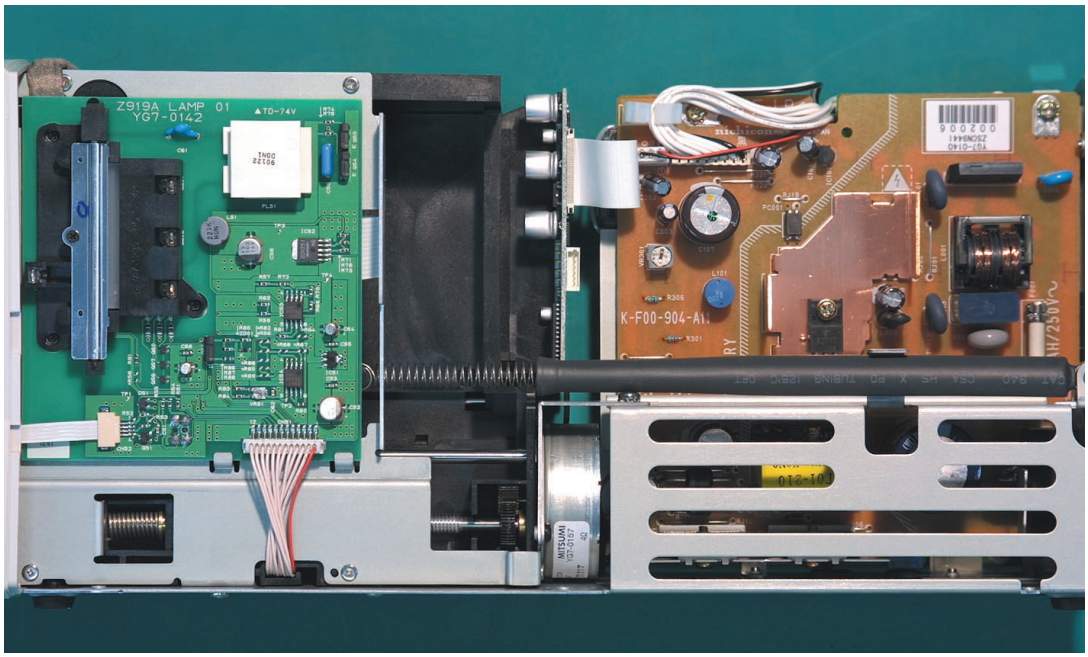

Fig. 3-17b

CHAPTER 4

INSTALLATION

The product is factory adjusted and inspected strictly.
The installation work is important for exhibiting the same performance of machine after unpacking at the site of customer as inspected at the factory.
The service engineer must install the machine in a place of good environmental conditions in a proper procedure and properly inspect it upon sufficiently understanding the machine performance.

I. INSTALLATION SUGGESTIONS ..... 4-1 **II. UNPACKING PROCEDURE 4-2**

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I INSTALLATION SUGGESTIONS

As conditions of installation place, the following can be enumerated.

Before carrying the scanner to the site of customer, therefore, it is advised to visit the place where the scanner is to be installed.

■ The temperature must be 5 to 35·C, and the humidity 10 to 90%. Avoid a place near water tap, water boiler, humidifier or refrigerator.

■ Avoid a place near fire, or exposed to dust or direct sunshine. If it is obliged to select a place exposed to direct sunshine, use a curtain on the window, where possible.

■ Do not block the radiation opening on the side of mainframe.

■ The room must be well ventilated.

■ The scanner must be kept level.

■ If the scanner is to be placed on a bench or the like, select as sturdy one as possible.

■ Keep the scanner away enough from the wall to operate it. (See Fig. 4-1.)

■ Precautions in installation

If metal kept in a cold place is brought to a warm place, dews may be formed on it. It is referred to as a condensation. If you use a scanner suffering from a condensation, reading may be troubled. Therefore, before unpacking in a warm room a scanner which was kept in a cold place, leave it for at least 1 hour so that its temperature will rise near the room temperature.

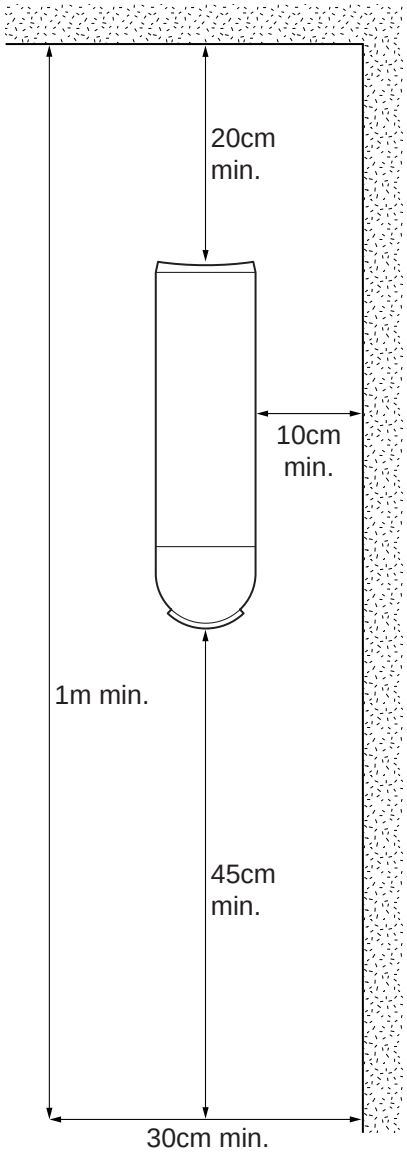

Fig. 4-1

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II UNPACKING PROCEDURE

No.	Procedure	Check	Remarks
1	Open the side lid of the outer carton, and pull out the inner carton bodily.		See Fig. 4-2.
2	Take out articles which are packed together, and then the film scanner along with the foam packing.	Make sure the contents are as specified.	
3	Remove the form packing, open the poly bag, and take out the film scanner.		

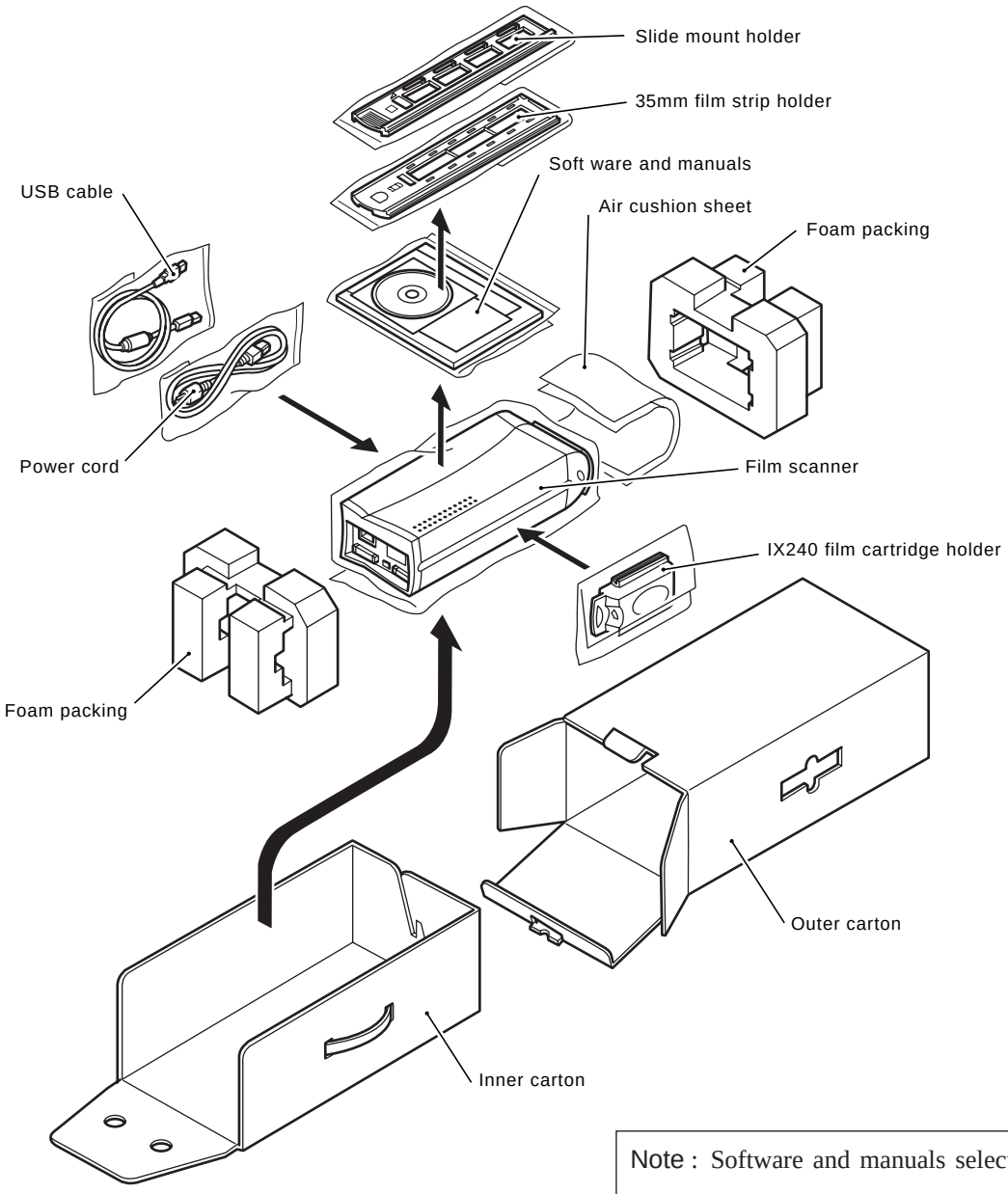

Fig. 4-2

Note : Software and manuals selected for particular product code are packed together.

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CHAPTER 5

MAINTENANCE AND CHECKUP

I. PERIODICAL REPLACEMENT PARTS 5-1
II. CONSUMABLE PARTS DURABILITY 5-1
III. PERIODICAL SERVICING 5-1
IV. SPECIAL TOOL LIST 5-1

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I PERIODICAL REPLACEMENT PARTS

There are no parts which must periodically be replaced.

II CONSUMABLE PARTS DURABILITY

There are no consumable parts.

III PERIODICAL SERVICING

Nothing needs to be periodically serviced.

IV SPECIAL TOOL LIST

The following shows tools necessary for servicing the scanner.

1. Color chart (CY9-5310-000)

Use : Picture quality check.

2. Adjusting software

2 types of adjusting software are provided with this service manual.

(1) FS_I_CHK

Use : Error correction and operation check for reference positions after replacing scanner unit.

(2) 90PER4ME

Use : Analog adjustment after replacing parts.

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CHAPTER 6

COUNTERMEASURES AGAINST IMAGE TROUBLES AND MALFUNCTIONS

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I INTRODUCTION

A. Initial checkup

1. Installation environment

Make sure the operating environment conform to the following criteria.

1) The source voltage fluctuation is kept within ±10%.
2) The scanner is kept level on flat desk, bench or the like.
3) The ambient temperature and humidity conform to specified conditions (see Chapter 1, II. Specifications).
4) The scanner is not installed in a place exposed to high temperature, high humidity (near water tap, water boiler, humidifier) or dust, or near fire.
5) The scanner is kept away from direct sunshine, using a curtain or the like as required.
6) The ventilation is ensured.

B. Others

Before checking the scanner suffering from troubles without having to use an external device, be sure to electrically detach the scanner and external device from each other.

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C. Remedying the troubles

1. Poor image

If the image is poor, carry out a hue check using the Auto-Check-1 of checking/adjusting software [FS_I_CHK] or PhotoShop LE to be stated later according to the phenomenon and, depending on the result, replace the scanner unit.

-1. Image is not output/is incomplete	1) Check the USB or SCSI cable connection. 2) Carry out Lamp ON/OFF Check in Auto-Check-1.
-2. Poor resolution	Replace the scanner unit.
-3. Irregular density	Carry out Lamp ON/OFF Check as in Auto-Check-1.
-4. Image blurring	Replace the scanner unit.
-5. Poor optical performance	Replace the scanner unit.
-6. Abnormal color	Proceed to hue check.

2. Poor operation

If the operation is poor, basically replace a problematic unit.

Main faulty phenomena are as follows.

-1. Does not operate	1) Check the USB or SCSI cable connection. In case of SCSI connection, carry out SCSI Configuration check as in Auto-Check-1 (p. 6-6). 2) Also, take actions according to messages indicated on the PC monitor (driver, application re-installation, etc.) 3) Replace the main circuit board.
-2. Would not turn on	1) Check the AC cable connection. 2) Replace the power circuit board.
-3. Carriage does not operate	Replace the scanner unit.
-4. Film holder does not work properly	1) Check whether the film holder is disfigured or not. 2) Replace the scanner unit.
-5. Focus drive motor does not operate	Replace the scanner unit.
-6. Lamp would not light	Replace the scanner unit.
-7. Infrared LED would not light	Replace the scanner unit.

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II CHECKING/ADJUSTING SOFTWARE

A.Outline

For servicing the scanner, 2 kinds of dedicated software are prepared, one being "FS_I_Chk" for image/function check and adjustment, and the other "90per4mE" for analog adjustment. They are edited in English and furnished as service manual CD-ROM.

Additionally, PhotoShop 5.0LE packed together with the scanner is used for hue check.

Check and adjustment using such software are made with PC and scanner subjected to SCSI connection.

B.Operating environment

For using the check/adjusting software, the following is required.

- CanoScan FS4000US (jointly packed film holder, PhotoShop 5.0LE also used)
- PC/AT compatible PC

CPU Pentium 133 MHz min.

Memory 64 MB min.

Hard disk With vacant and available capacity 300 MB min. (enough to save scan image)

Display size XGA (1024x768 dpi) min., 16 bit color or better

OS Windows 98/Millennium Edition

SCSI board (Commercially available one). Adaptec AHA-2940AU is recommended.

SCSI cable (Commercially available one)

Hue checking film (set of 2 negative films for specific scenes)

Tool number : CY9-5310-000

Tool name : COLOR CHART

> The film may suffer from discoloration or other deterioration on account of light. When unused, protect it from light and keep it in a cold and dark place, where possible.

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C.Preparation before checking

1. Installing the check software "FS_I_CHK"

Start up the CD-ROM of FS_I_CHK\INSTALL\SETUP.EXE and, according to instructions, execute it.

C:\Fs_i_chk folder will be created and registered as a start menu.

2. Registration of application software for scan image display

Designate a photo type application installed in PC used for scanned image display.

In default, Photoshop 5.5 is registered. To change the software, open C:\Fs_i_chk\Autocheck.cfg, change the path of [Tiff] tag of viewer= and startup file, and save it. The following description is an example for change to Adobe Photoshop 5.0LE.

Example : viewer=C\Program Files\Adobe\Photoshop 5.0J LE\photosle.exe

D.Check items of check software "FS_I_CHK"

Check software "FS_I_CHK" has following check items.

1. Auto-Check-1 (automatic image evaluation 1)

-1. Timer	Clock function : Relative time (sec) with respect to PC timer
-2. SCSI Configuration	SCSI connection information
-3. Lamp ON/OFF Check	Lamp ON/OFF, light quantity check
-4. LED ON/OFF Check	Infrared LED (for dust/scratch correction) ON/OFF, light quantity check
-5. Color Patch	Color patch test→Not carried out
-6. Defective Pixel Check	Defective Pixel Check
-7. ROM Version	ROM Version→Carried out as required

Auto-Check-2 (automatic image evaluation 2) will not be carried out.

2. Read Information

-1. Read Scan Status (Read scan condition set values)

-2. Read Status (Read status : Normal, busy, error, etc.)

3. SCAN

-1. Thumbnail Scan

-2. Scan

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E. Executing a check

Carrying out Auto-check-1

-1. Start up FS_I_Chk, and click on □ for an item to be checked.

Remove a check mark from "Color Patch" test.

-2. On the scanner, set a slide mount holder where no slide is installed.

-3. Press the [Start] button.

If the film holder is not set, a message will appear.

-4. "Testing ..." appears in the Judgment box for an item under way. At the end of check, "OK" or "*NG*" appears* in the Judgment box.

At the end of check for all selected items, "OK" or "*NG*" appears* in the Total Judgment box.

* OK/NG judgment is made upon comparison with a value described in C:\Fs_i_chk\Checkvalue.txt. For details of Checkvalue.txt, refer to p. 6-18 and 19.

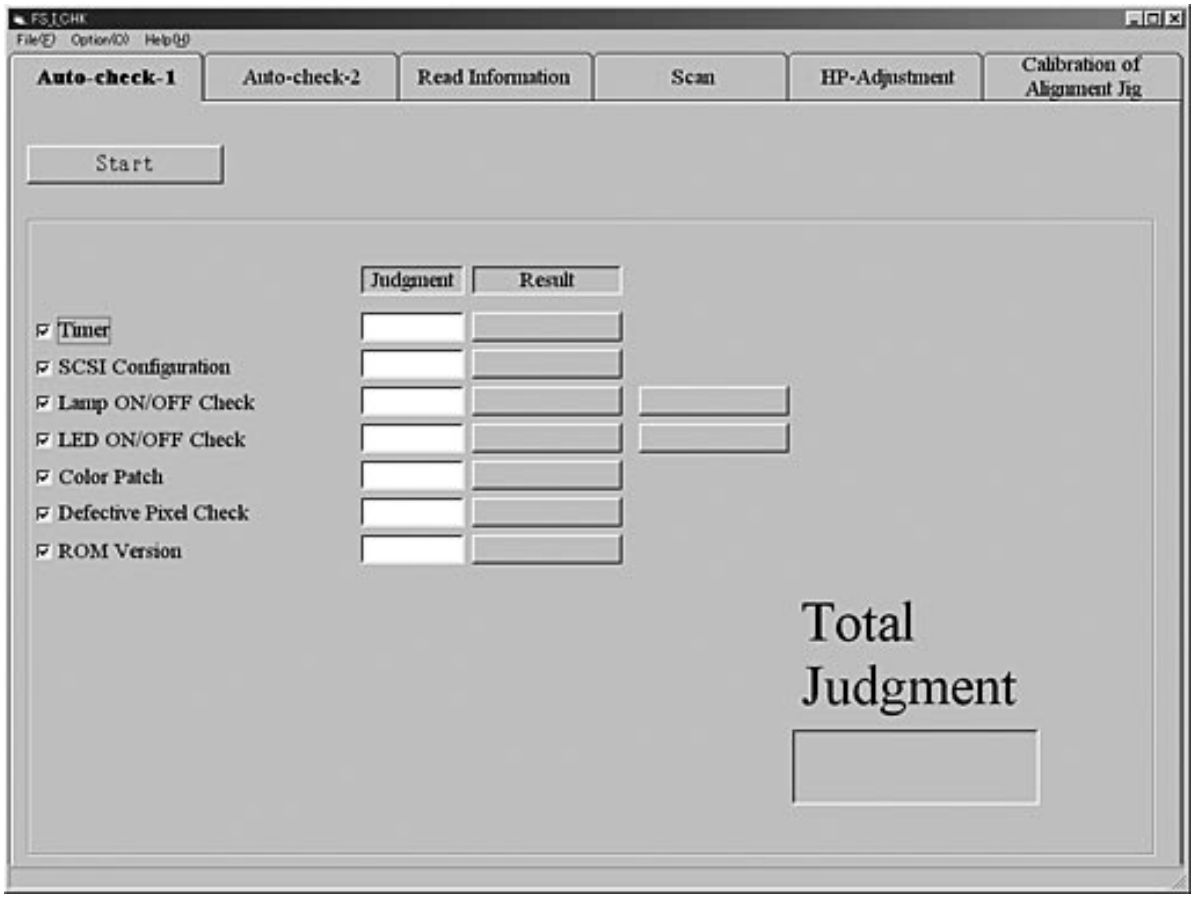

Fig. 6-1

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F. Detailed explanation on functions

1. Items of Auto-check-1 (automatic image evaluation 1)

1-1. Timer (clock function)

Function : Measures the relative time with respect to PC timer.

Judgment : Indicates the reading (in sec) in the "Result" box.

Action : If judged NG, replace the scanner unit.

1-2. SCSI Configuration (indication of SCSI connection information)

Function : Scans all devices on SCSI bus.

Pressing the [Detail] button indicates the following information on another window. (See Fig. 6-2.)

ID : ID number for device on SCSI bus

Vender ID : Manufacturer of device

Product ID : Product name (IX400015G is a code of FS4000US)

Revision : Revision number of firmware (1.07 when marketed first)

ID SW : Position (0-9, A-F) of setting ID switch for FS4000US

Term : Validity (valid: On, invalid: Off) of terminator of FS4000US

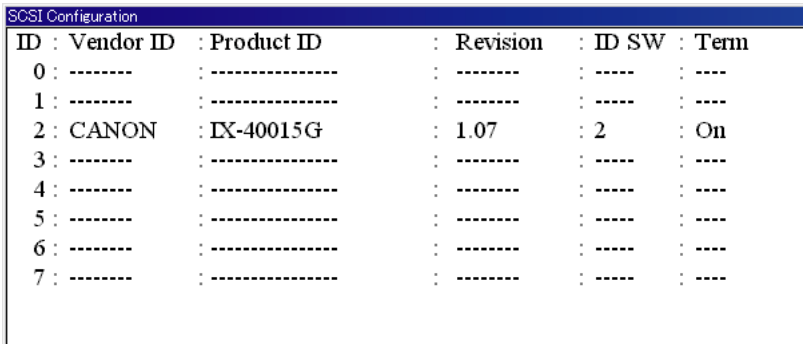

Fig. 6-2

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1-3. Lamp ON/OFF Check (lamp ON/OFF, light quantity check)

Function : Checks lamp ON/OFF and light quantity.

Fetches 10 data at 4000 dpi fixed on the shading window, removes 2 data each from the top and bottom for each of pixels to make 6 remaining data valid, and averages the valid data as lamp light quantity data.

Judgment : If NG,

"Result"	Symptom	Check/Remedy
ON Error	Lamp cannot turn on	Replace scanner unit
OFF Error	Lamp cannot turn off	Replace scanner unit
Insufficient	Lamp light quantity is poor	Replace scanner unit
Over	Lamp light quantity is excessive	Replace scanner unit

Details : Pressing the [Chart] button displays a lamp output characteristics graph on another window. Press the [View+] button to extend the graph. Press the [View-] button to return from the extended graph.

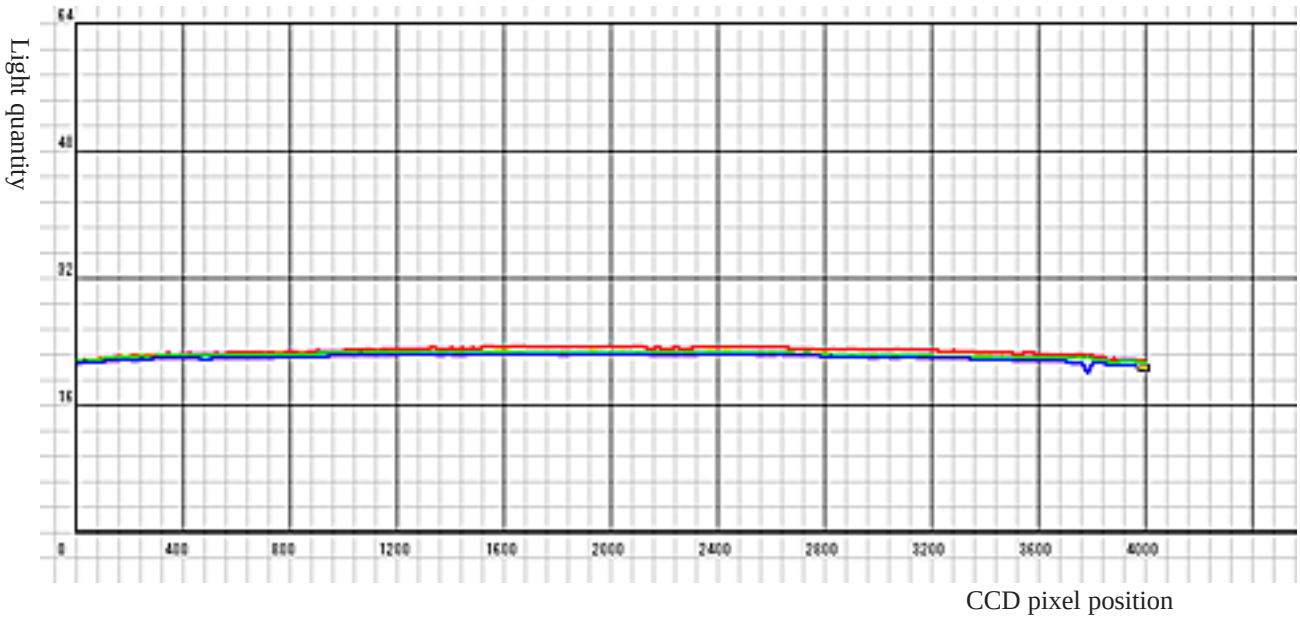

Fig. 6-3

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1-4. LED ON/OFF Check (infrared LED ON/OFF, light quantity check)

Function : Carries out ON/OFF and light quantity check of infrared LED for particle and scratch detection.
Fetches 10 data at 4000 dpi fixed on the shading window, removes 2 data each from the top and bottom for each of pixels to make 6 remaining data valid, and averages the valid data as LED light quantity data.

Judgment : If NG,

"Result"	Symptom	Check/Remedy
ON Error	LED cannot turn on	Replace scanner unit
OFF Error	LED cannot turn off	Replace scanner unit
Insufficient	LED light quantity is poor	Replace scanner unit
Over	LED light quantity is excessive	Replace scanner unit

Details: Pressing the [Chart] button displays a LED output characteristics graph on another window.

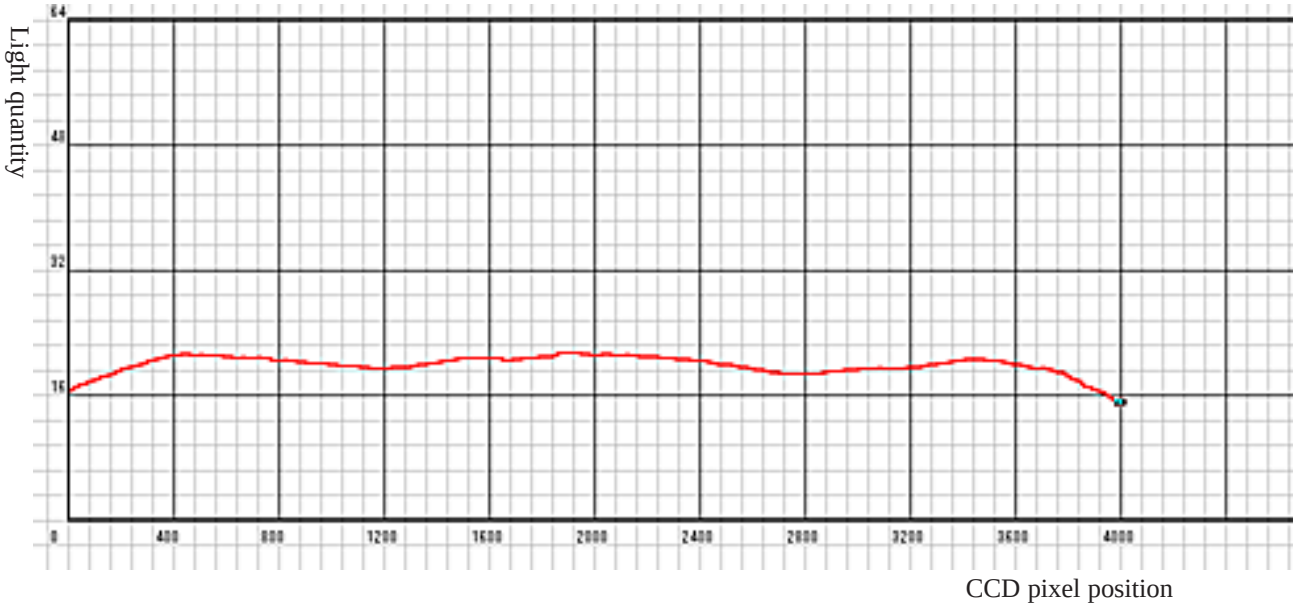

Fig. 6-4

1-5. Color Patch (color patch test)

Not carried out.

The color check is made in the form of hue check as on p. 6-12 and 6-13.

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1-6. Defective Pixel Check

Function : After executing the lamp ON/OFF check, acquires lamp light quantity data.

Carries out measurement for all pixels. If below a threshold value designated by Checkvalue.txt, assumes a defective pixel. Checking stops as soon as 20 defective pixels have been counted without being pursued to the end.

Judgment : If NG, replace the scanner unit.

Check result : Pressing the [Detail] button indicates the check result on another window.

RGB	Pixel Position	MIN	MAX	Measurement Value

Fig. 6-5

1-7. ROM version

Function : Indicates the firmware version and check sum.

Example of indication: 1.07:9F92:7637 ... Ver. 1.07. Other ... Check sum.

Judgment : Deemed "NG" for other than combination of version and check sum described in Checkvalue.txt.

Remarks : On account of reasons discussed above, remove check marks from check boxes unless particularly required.

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2. Read Information

Function : Read Scan status : Reads out the scan status.

Read Status : Reads out the status.

Result : Pressing a corresponding [Read] button indicates a read-out results on another window.

3.1 Read Scan status

Get window

X Resolution	: Resolution [dpi] in horizontal scanning direction
Y Resolution	: Resolution [dpi] in vertical scanning direction
Upper Left X	: In decimal notation [pix]
Upper Left Y	: In decimal notation [pix]
Width	: In decimal notation [pix]
Length	: In decimal notation [line]
Image Composition	: Multi-Level RGB Color/Multi-Level Black&White
Bit per Pixel	: Depth [bit] of each selected color

Get Scan Mode

SSD	
SCAM	
SYNC	: Indicates ASYNC/SYNC
Transfer Period	: In decimal notation ([acquired value]x40) [ns]
AutoClamp	: Indicates Clamp OFF/Clamp ON
Data TX Order	
Gain RED	: In decimal notation ; Gain=5.8/(1.0+4.8((63.0-[acquired value]/63.0 [V/V]
Gain Green	: Ditto
Gain Blue	: Ditto
Shutter RED	: In decimal notation ([acquired value]/10) [%]
Shutter Green	: Ditto
Shutter Blue	: Ditto
Adjoining Pixel Proccess Tpe	
Process Tpe	

Get Film status

Holder Type	: Type of inserted holder/adapter
Frame Max.	: In decimal notation
Position Count	: In decimal notation
AF_Area_Start	: In decimal notation
AF_Area _End	: In decimal notation

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Scanned Position	: Indicates Move HP/Standstill
Direction	: Indicates Forward/Reverse/2/3/Now
Data Disk	: Binary notation (in 8 bit-8 bit)
AF Count	: In decimal notation
AF Value Red	: In decimal notation
AF Value Green	: In decimal notation
AF Value Blue	: In decimal notation
FH SLIT Count	: In decimal notation
AF Peak Position R	: In decimal notation
AF Peak Position G	: In decimal notation
AF Peak Position B	: In decimal notation

Get Power ON Timer	Lapse of time from Power ON
Time	: In hh:mm:ss

3.2 Read Status Indicates in hexadecimal notation the value acquired by Request Sense

SenseKey :	0h
Additional :	0h
AdditionalQ :	0h
Error :	No Error

3. Scan

Each [Scan] button is valid only after pressing the [Scan Parameter] button.

Function : Thumbnail Scan : Pressing a [Scan] button carries out scanning at 160 dpi according to conditions of Scan Parameters of Holder and Film, and the read image is saved in CHK_Thm.tif.

Scan : Pressing a [Scan] button carries out scanning according to conditions of Scan Parameter, and the read image is saved in CHK_Scan.tif.

Starts up the application registered in Autocheck.cfg, and displays a scanned image.

Scan Parameter : Pressing the button displays the Scan conditions.

Limitations ;

Film: Normal execution is impossible for Scan for which is selected Film: Positive Monochrome or Negative Monochrome, or SCAN MODE: Gray 14 bit, 8 bit or Monochrome.

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4. Hue check

Details of check

Using Adobe PhotoShop 5.0LE, scans a negative film (dedicated tool) for hue check, and compares for judgment the results with values specified for each of R, G and B on histogram.

CAUTION: For this check, do not use software other than PhotoShop 5.0LE.

Installing the application software (PhotoShop 5.0LE)

Install the Adobe PhotoShop 5.0LE packed together with the scanner according to instructions.

Preparation

-1. Set the negative film for hue check at frames 1 and 2 of 35 mm FILMSTRIP HOLDER.

In doing this, align the base part between 2 frames with notches of film holder, and fasten the film top and bottom on the folder with sello tape or the like.

CAUTION: When attaching, the tape must be away from the image.

-2. Close the Holder, and set it on the scanner.

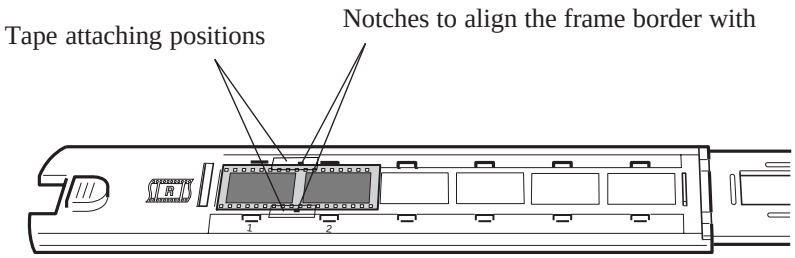

Fig. 6-6

Procedure

[1] Fetching an image

-1. Start up the PhotoShop 5.0LE, select "File" menus/Inputting plug/Select TWAIN_32 compatible device ..., select Canon FilmGet FS 1.0 for Windows, and press the [Select] button.

-2. Execute the "File" menus/Inputting plug/Input from TWAIN_32 compatible device. → FilmGet FS 1.0 for Windows panel appears.

-3. Execute the "Set" menus and "Return to initial setting".

-4. On the FilmGet FS 1.0 for Windows panel, set the scan resolution to 500 dpi for each of main and sub-scanning directions.

-5. On the Thumbnail panel, select the frame number 1 or 2, and press the [Scan] button on the FilmGet FS 1.0 for Windows panel to proceed to scanning.

-6. After the end of scanning, close the FilmGet FS 1.0 for Windows panel to resume the PhotoShop LE.

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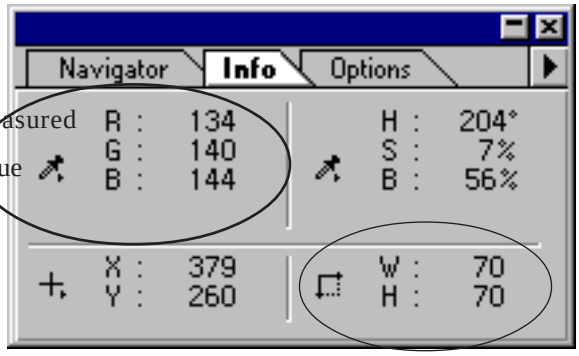
Fig. 6-7

Specified values* (attached on film case)

	R	G	B
Upper limit	143	149	157
Lower limit	129	136	138

* Values differ from one film to another



Size (in pixels) of selected range

Fig. 6-8

[2] Checking the hue

-1. Click on the part of "Information" out of "Navigator/Information/Option" panel displayed on the upper right of PhotoShop.→A screen appears as shown in Fig. 6-8.

-2. By PhotoShop select tool, select a square area of 70x70 [pixels] on the center of gray part of the scanned image. (For unit, click on "+", and select pixles.)

-3. Execute Filter/Graduation/Graduation (Gaus) ... Here, set the Radius to 3.0 pixels.→The gray in the selected range smoothens.

-4. Position the mouse pointer within the selected range, and make sure the values measured for R, G and B indicated on the information panel are within specified ranges.

• Action

If the measured values are excessively deviated from specified values, replace the scanner unit.

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G. Adjustment Part

Carrying out the adjustment

If the scanner unit (P/N: DY4-6450-000, Description: SCANNER ASS'Y)/main circuit board (P/N: YG7-0139-000, Description: MAIN PCB ASS'Y) are replaced, the following adjustments are required.

1. Writing scanner unit adjusting values (use FS_I_CHK)
2. Analog adjustment (use 90per4mE)

1. Writing scanner unit adjusting values

*Details

The scanner unit is provided with 3 photo interrupters for detecting the home positions of AF, carriage, and holder. Mounting position errors peculiar to these photo interrupters must be offset. Write the adjusting values into EEPROM on the main circuit board using FS_I_CHK when the scanner unit/main circuit board are replaced.

*Installing the software (FS_I_CHK)

Refer to "Installing the check program" on p. 6-2.

*Precautions before execution

Make sure the PC and scanner are connected by SCSI cable.

At this time, do not connect other than this scanner to the SCSI bus.

Terminate FilmGet FS and other software that uses SCSI bus.

*Acquiring scanner unit adjusting values

1) When replacing the scanner unit

Data sheet in a plastic bag is attached on the package of the scanner unit (Fig. 6-9).

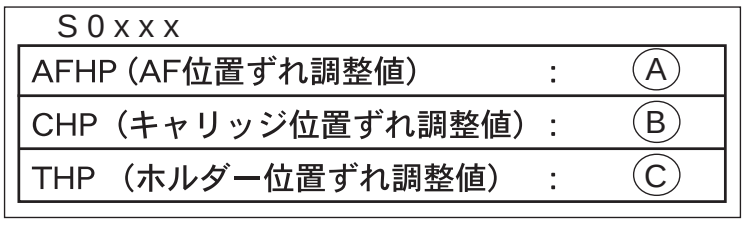

Fig. 6-9

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2) When replacing the main circuit board

-1. If the scanner can communicate with the PC by the SCSI connection:

Start up FS_ICHK and select “HP-Adjustment” tab to display “EEPROM Compensation Read/Write” area enclosed by a red box (fig. 6-11 on p. 6-16). Press the [Read] button to view the adjusting values. Note that no value is displayed or error data may be displayed due to the main circuit board conditions.

-2. If the scanner cannot communicate with the PC by the SCSI connection:

Acquiring the adjusting values depend on the serial number “AZXxxxxx” attached under the bar code on the rear panel upper part.

* AZX00001 - AZX20083

Adjusting values are written in Scanner Test\Scanner Data**Scanner Data.xls** on the service manual CD-ROM. Read from the left S/N (Serial number), AFHP (AF off-position adjusting value Ⓐ), CHP (carriage off-position adjusting value Ⓑ), THP (holder off-position adjusting value Ⓒ).

Confirm the adjusting values from [Menu] - [Edit] - [Find (by S/N)]

* AZX20084 and after

Adjusting value is hand written on the metal part of the scanner

unit side (diagonally red shaded areas in fig. 6-10). Note the order of the adjusting values.

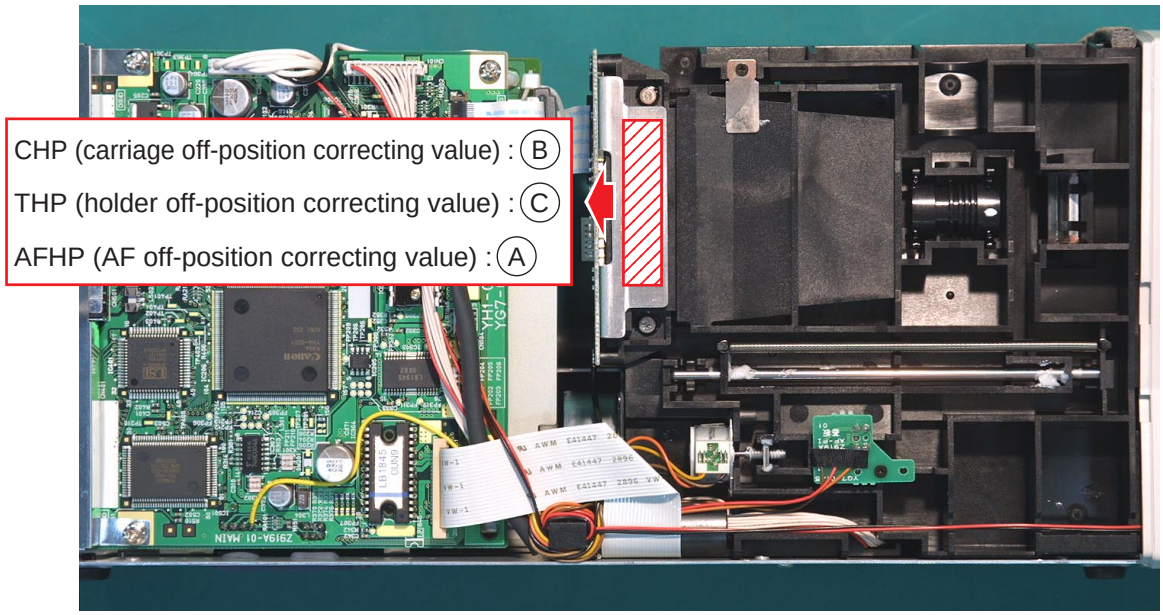
CHP (carriage off-position correcting value) : B
THP (holder off-position correcting value) : C
AFHP (AF off-position correcting value) : A

Fig. 6-10

*Procedure

1. Start up FS_ICHK.
2. Select “HP-Adjustment” tab.
3. Input the scanner unit adjusting values A, B, and C into the value indicating/writing section for:

Focus Adjustment	(A)	(value from 0-150)
Film Carriage HP Adjustment	(B)	(0-504)
Thumbnail HP Adjustment	(C)	(even value from 0-40)

   in EEPROM Compensation Read/Write” area, and press the corresponding [Write] buttons.
4. A message “Is it writing O.K.?” appears each time. Press the [Yes] button.
5. After writing, press the [Read] button to confirm values are correctly written.

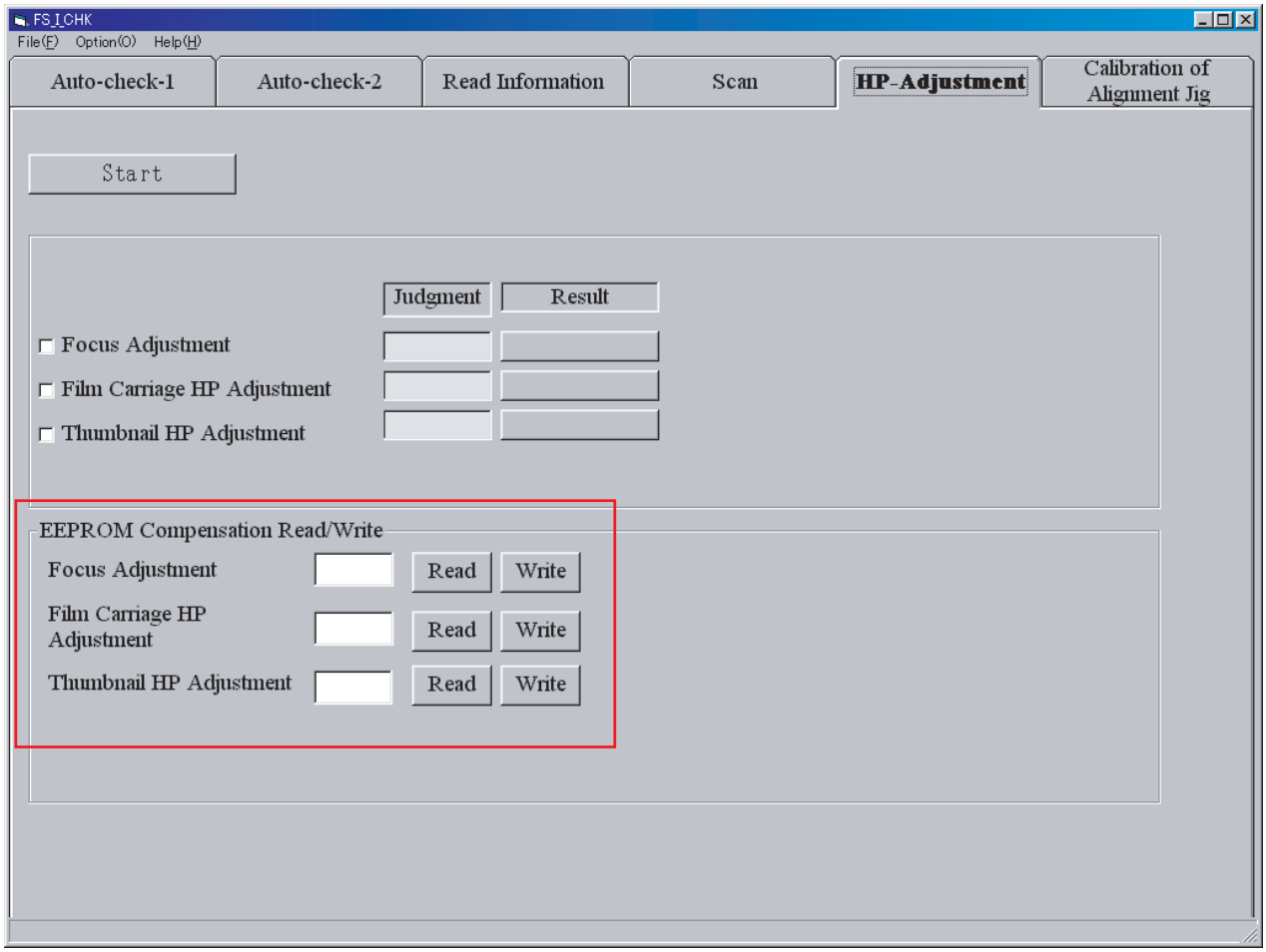

Fig. 6-11

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2. Analog adjustment

Details of adjustment

Optimize the shutter aperture for CCD with respect to the lamp light quantity.

Installing the software (90per4mE)

Copy "90per4mE" folder from CD-ROM to a desired place of the hard disk on PC.

Confirmation/precautions before execution

Make sure the PC and scanner are connected by SCSI cable, and that the interface selector switch is set at SCSI.

At this time, do not connect other than the scanner to SCSI bus.

Terminate FS_I_CHK, FilmGet FS or other software which uses SCSI bus.

Do not set the film holder.

Procedure

1. Start up 90per4mE.exe. (The main panel LogForm opens.)
2. Press the "Start" button. (Characters "Start" on the button center are highlighted.)
3. Wait for approximately 4 minutes. (The lamp lighting stabilizes.)
4. The adjustment ends when the "Start" button has been validated.
5. Pressing [X] button on the window displays a message "Closed!". Then, press the [OK] button to terminate the software. (After the end of first adjustment, "LinearityLog.txt" file will be created in the folder.)

Fig. 6-12

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Memo

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H. Information of related files

-1. Details of Autocheck.cfg (default values)

[AutoTest]	[Automatic evaluation test item selection].0: Validate. 1: Invalidate.
0=1	Clock function test
1=1	SCSI connection information test
2=1	Lamp ON/OFF check
3=1	LED ON/OFF check
4=0	Reserve
5=0	Reserve
6=1	Color patch test
7=1	Defective pixel check
8=0	Reserve
9=0	Reserve
10=0	Reserve
11=0	

[Tiff]	[Definition of file viewer for scanned image indication]
Colors=48	Gradations of image to be displayed
viewer=C:\Program Files\Adobe\Photoshop 5.5\photoshp.exe	
;Colors=24	
;viewer=C:\WINDOWS\KODAKIMG.EXE	

[Serial No]	[Serial number input Yes/No]
Enable=0	0: No. 1: Yes.
Enable2=10	

[Adjust]	[Automatic adjustment item selection]
0=0	Focus adjustment
1=0	Carriage HP adjustment
2=0	Thumbnail HP adjustment
3=1	Image resolution check
4=1	Pixel deviation check
5=1	Right angle/Linearity/Magnification/Tilt/CCD Center position error check

[Parts No]

Text=CY9-5309-000

-2. Details of Checkvalue.txt (default values)

```
[PowerOnTimer]
Interval=5
Max=6
Min=4

[SCSI]
Product=IX-40015G

[LampOnOff]
WhiteMin=0              Upper limit when ON
WhiteMax=50000          Lower limit when ON
BlackMin=0              Upper limit when OFF
BlackMax=10000          Lower limit when OFF
From=0                  Judgment start pixel position
To=3999                 Judgment end pixel position

[LedOnOff]              Ditto
WhiteMin=0
WhiteMax=50000
BlackMin=0
BlackMax=10000
From=0
To=3999

[LampVolume]
ymax=64000              Max. value on ordinate of graph

[LedVolume]
ymax=64000              Max. value on ordinate of graph

[DefectivePixcelCheck]
StartPos=50             Judgment start pixel position
EndPos=3950             Judgment end pixel position
Min=10000               Lower threshold
Max=40000               Upper threshold

[RomVersion]
Version=1.05:8400:38D6

[ColorPatch]            Subsequent items are not checked
CalStartX=20
CalEndX=140
CalStartY=20
CalEndY=100
vSep=37000
'OffX=77
'OffY=49
r=10
PosNum=42
;PosNum=1
1=312,54,0,70000,0,70000,0,70000
2=312,221,0,0,0,0,0,0
3=312,293,0,0,0,0,0,0
4=336,54,0,0,0,0,0,0
5=336,221,0,0,0,0,0,0
6=336,293,0,0,0,0,0,0
7=360,54,0,0,0,0,0,0
8=360,221,0,0,0,0,0,0
9=360,293,0,0,0,0,0,0
10=407,54,0,0,0,0,0,0
11=407,221,0,0,0,0,0,0
12=407,293,0,0,0,0,0,0
13=431,54,0,0,0,0,0,0
14=431,221,0,0,0,0,0,0
15=431,293,0,0,0,0,0,0
16=455,54,0,0,0,0,0,0
17=455,221,0,0,0,0,0,0
18=455,293,0,0,0,0,0,0

19=5,354,0,0,0,0,0,0
20=31,354,0,0,0,0,0,0
21=55,354,0,0,0,0,0,0
22=78,354,0,0,0,0,0,0
23=102,354,0,0,0,0,0,0
24=125,354,0,0,0,0,0,0
25=149,354,0,0,0,0,0,0
26=172,354,0,0,0,0,0,0
27=196,354,0,0,0,0,0,0
28=219,354,0,0,0,0,0,0
29=243,354,0,0,0,0,0,0
30=266,354,0,0,0,0,0,0
31=290,354,0,0,0,0,0,0
32=313,354,0,0,0,0,0,0
33=338,354,0,0,0,0,0,0
34=360,354,0,0,0,0,0,0
35=384,354,0,0,0,0,0,0
36=407,354,0,0,0,0,0,0
37=431,354,0,0,0,0,0,0
38=454,354,0,0,0,0,0,0
39=478,354,0,0,0,0,0,0
40=501,354,0,0,0,0,0,0
41=525,354,0,0,0,0,0,0
42=551,354,0,0,0,0,0,0

[Adjust Focus]
AdjustOffset=125
AdjustMinMax=5
YMax = 10000000
```


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[AdjustCHP]
X1=0
Y1=1750
X2=1000
Y2=2250
LogicalPos=365

[AdjustTHP]
X1=1000
Y1=1750
X2=2000
Y2=2250
LogicalPos=9.64

[Resolution]
X1=3000
Y1=1500
X2=4500
Y2=3000
MinResolution=0
MaxResolution=10000
Sep=10
MinSep=0

ThresHold=10000
//OffX=0
//OffY=0

[OffPixcel]
X1=0
Y1=1750
X2=1000
Y2=2650
Upper=20000
Lower=5000
YMax=62000

Min=0
Max=1

[StraightAngle]
AX1=0
AY1=500
AX2=500
AY2=3500

BX1=500
BY1=3500
BX2=5000
BY2=4000

MinA=0
MaxA=10
MinB=0
MaxB=10

ThresHold=10000

[RightAngle]
Min=88.5
Max=91.5

[Magnification]
MinA=99
MaxA=101
MinB=99
MaxB=101
LenA=1890
LenB=3780

[CCD]
Min=1900
Max=2100

[Angle]
Min=-0.5
Max=+0.5

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I. Error messages

1. FS_I_CHK

1-1. Set the Film Holder.

Cause : The SLIDE MOUNT HOLDER is not set on the scanner.

Remedy : Set the SLIDE MOUNT HOLDER.

1-2. Scanner is not found.

Cause : The scanner is not connected or the holder is being set/ejected.

Remedy : Check the SCSI connection and, if normal, wait for the holder to be set/ejected.

1-3. Execution time error "53"

No file is found.

Cause : It is attempted to display a scanned image, but the application designated by Viewer= of [Tiff] tag of Autocheck.cfg file is not found.

Remedy : Check the application path and execution file name, and describe them correctly.

1-4.Focus Compensation Value is not an effective number.

Film Carriage HP Compensation Value is not an effective number.

Thumbnail HP Compensation Value is not an effective number.

Cause : Focus compensation value, carriage HP compensation value or thumbnail HP compensation value is not effective.

Remedy : Input an effective value.

1-5. Focus Compensation Value is inputted less than by zero to 150.

Cause : It is attempted to write a value other than 0-150 wrongly inputted as Focus compensation value.

Remedy : Input an effective value.

1-6. Film Carriage HP Compensation Value is inputted less than by zero to 504.

Cause : It is attempted to write a value other than 0-504 wrongly inputted as Film Carriage HP compensation value.

Remedy : Input an effective value.

1-7. Thumbnail HP Compensation Value is inputted less than by zero to 40.

Cause : It is attempted to write a value other than 0-40 wrongly inputted as Thumbnail HP compensation value.

Remedy : Input an effective value.

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1-8. Thumbnail HP Compensation Value is inputted with even number

Cause : It is attempted to write an odd value wrongly inputted as Thumbnail HP compensation value.

Remedy : Input an effective even number within range of 0-40.

2. 90per4mE

2-1. Comterm

Cause : The scanner is not connected or is turned off.

Remedy : Check the SCSI connection and, if normal, turn on power.

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APPENDIX

I. GENERAL CIRCUIT DIAGRAM A-1
II-1. MAIN PCB (CPU BLOCK) A-2
II-2. MAIN PCB (ASIC BLOCK) A-3
II-3. MAIN PCB (MOTOR BLOCK) A-4
II-4. MAIN PCB (SCSI BLOCK) A-5
II-5. MAIN PCB (USB BLOCK) A-6
III. CCD PCB A-7
IV. LAMP PCB A-8
V. JUNCTION PCB A-9
VI. FRONT/AF-PI PCB A-10

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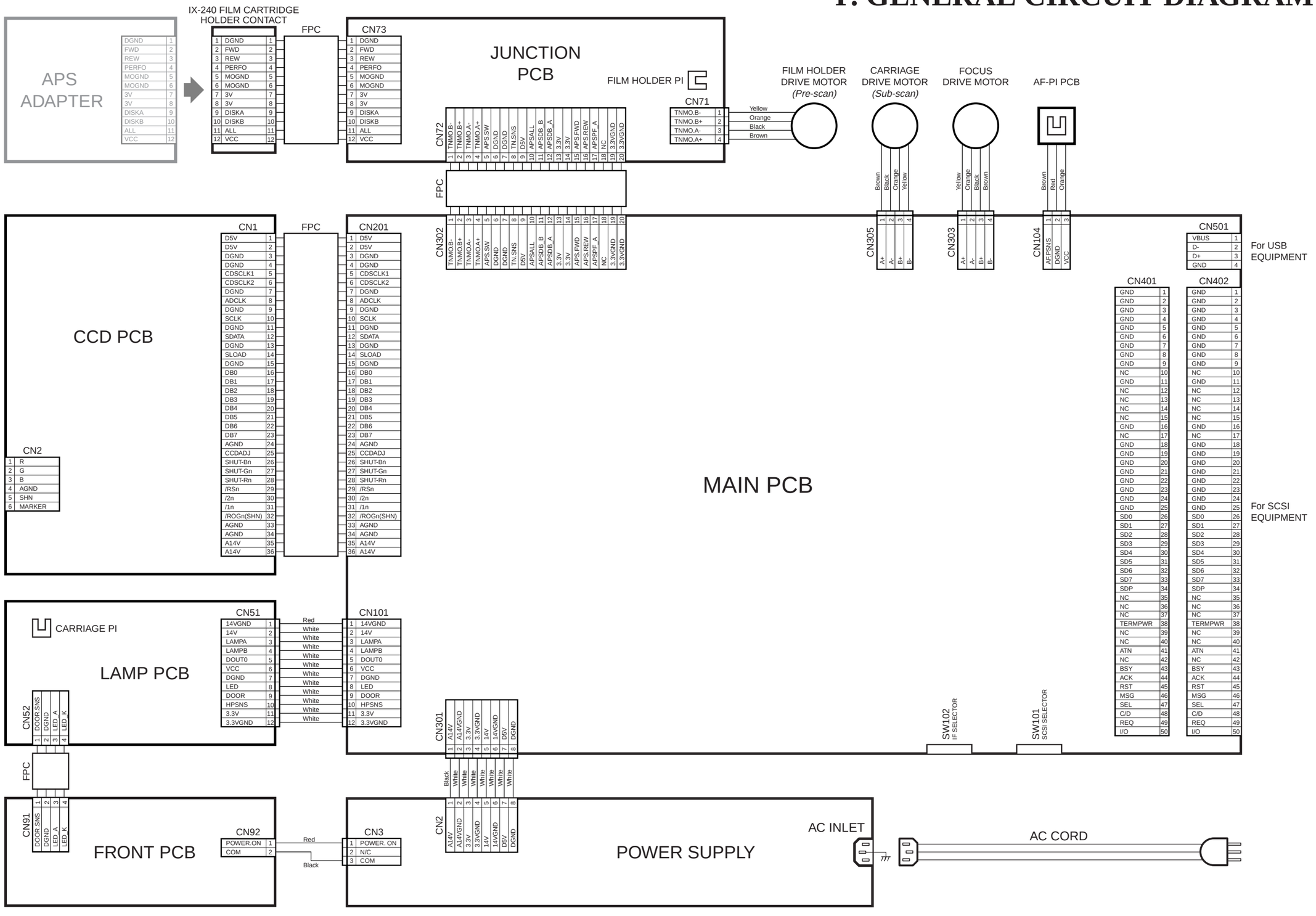
The indication ㊅ in the circuit diagram means that the device element is not mounted.

I. GENERAL CIRCUIT DIAGRAM



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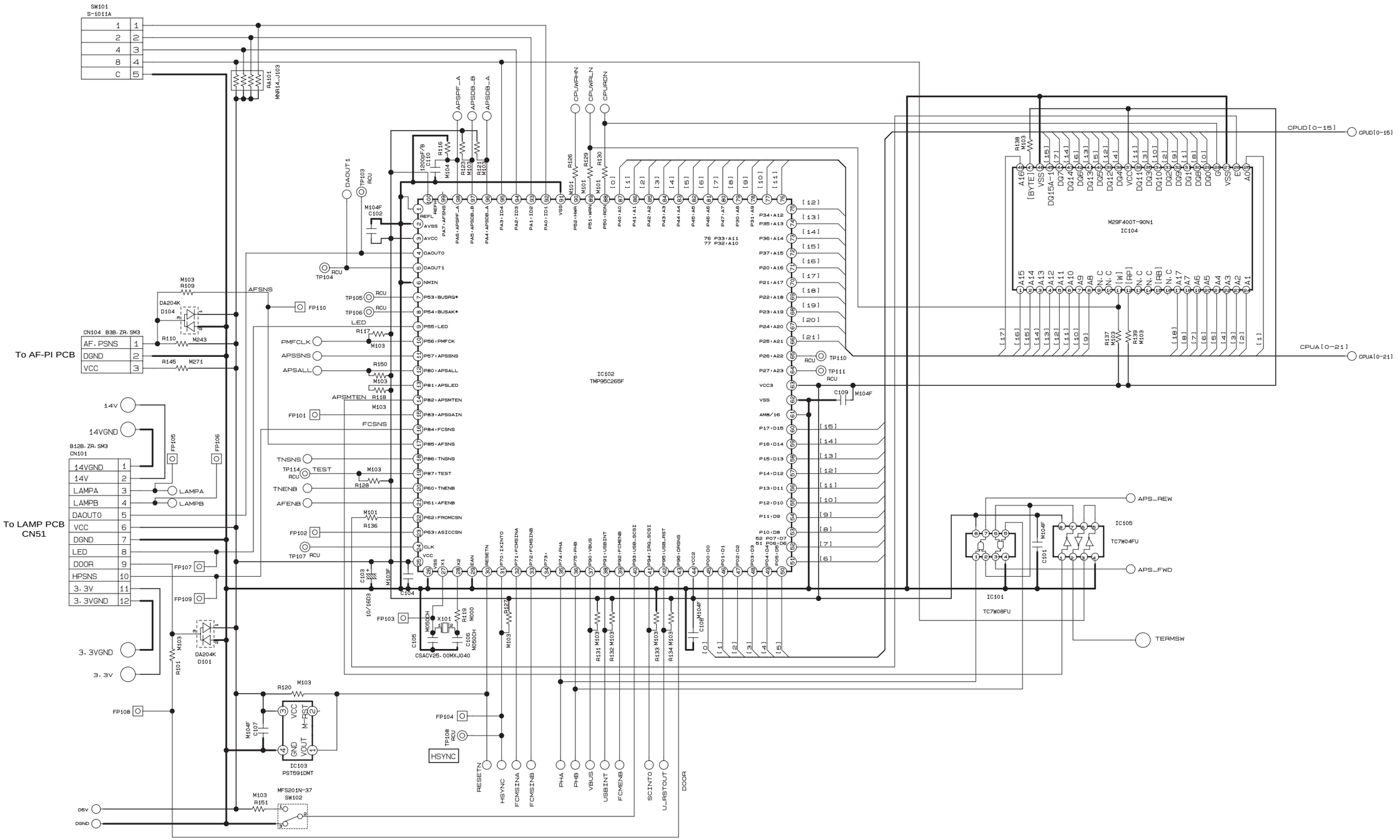
II-1. MAIN PCB (CPU BLOCK)



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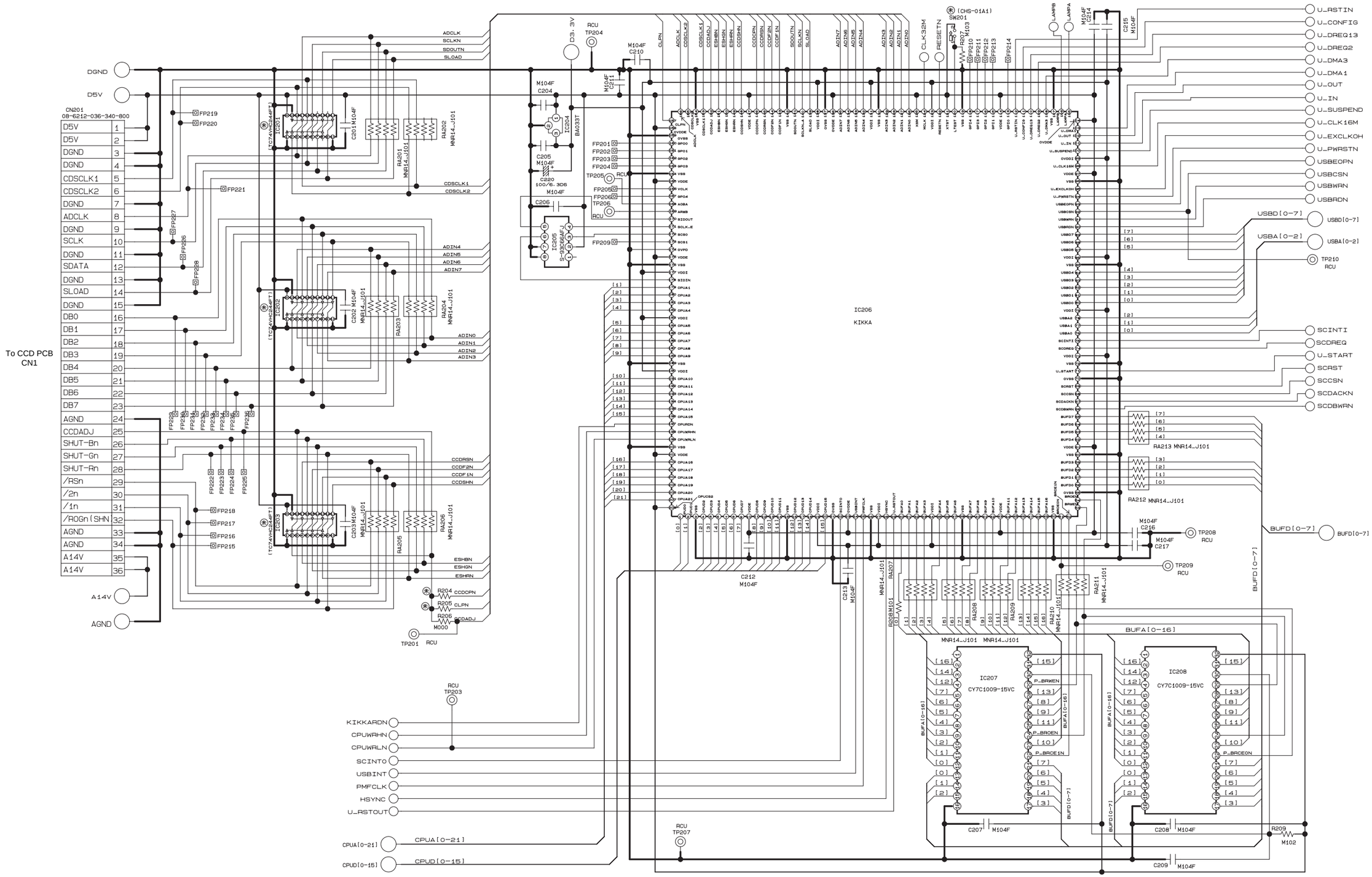
II-2. MAIN PCB (ASIC BLOCK)



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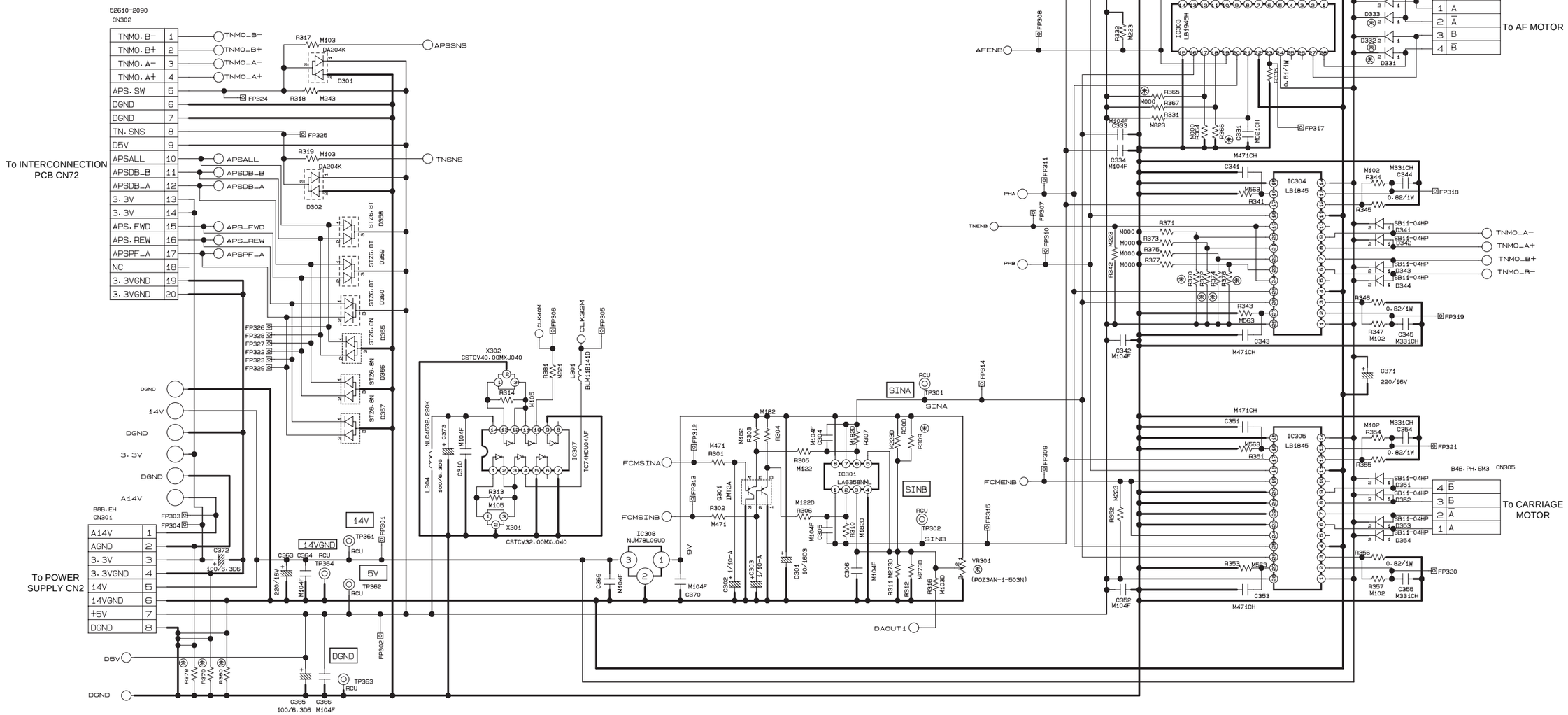
II-3. MAIN PCB (MOTOR BLOCK)



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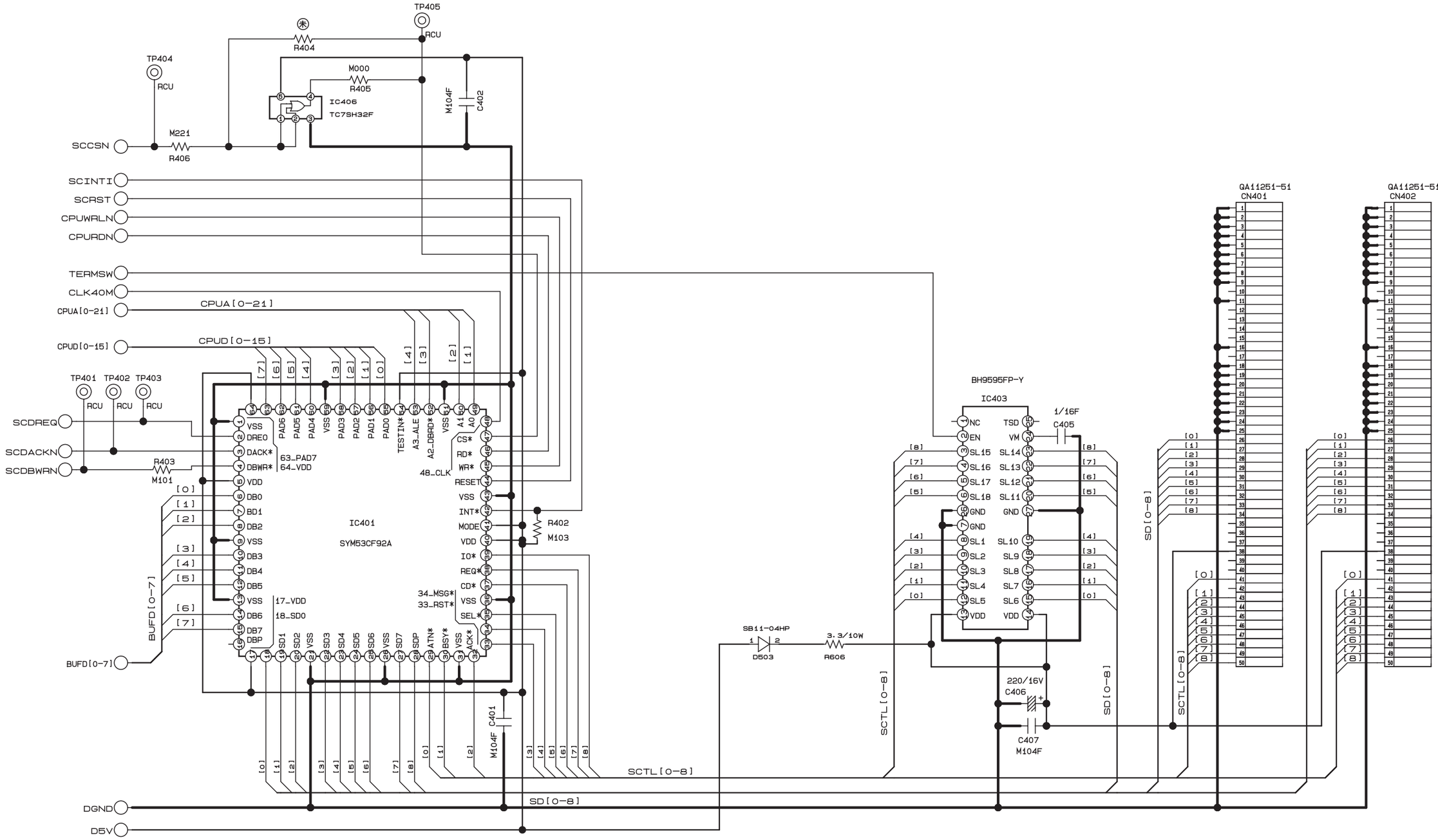
II-4. MAIN PCB (SCSI BLOCK)



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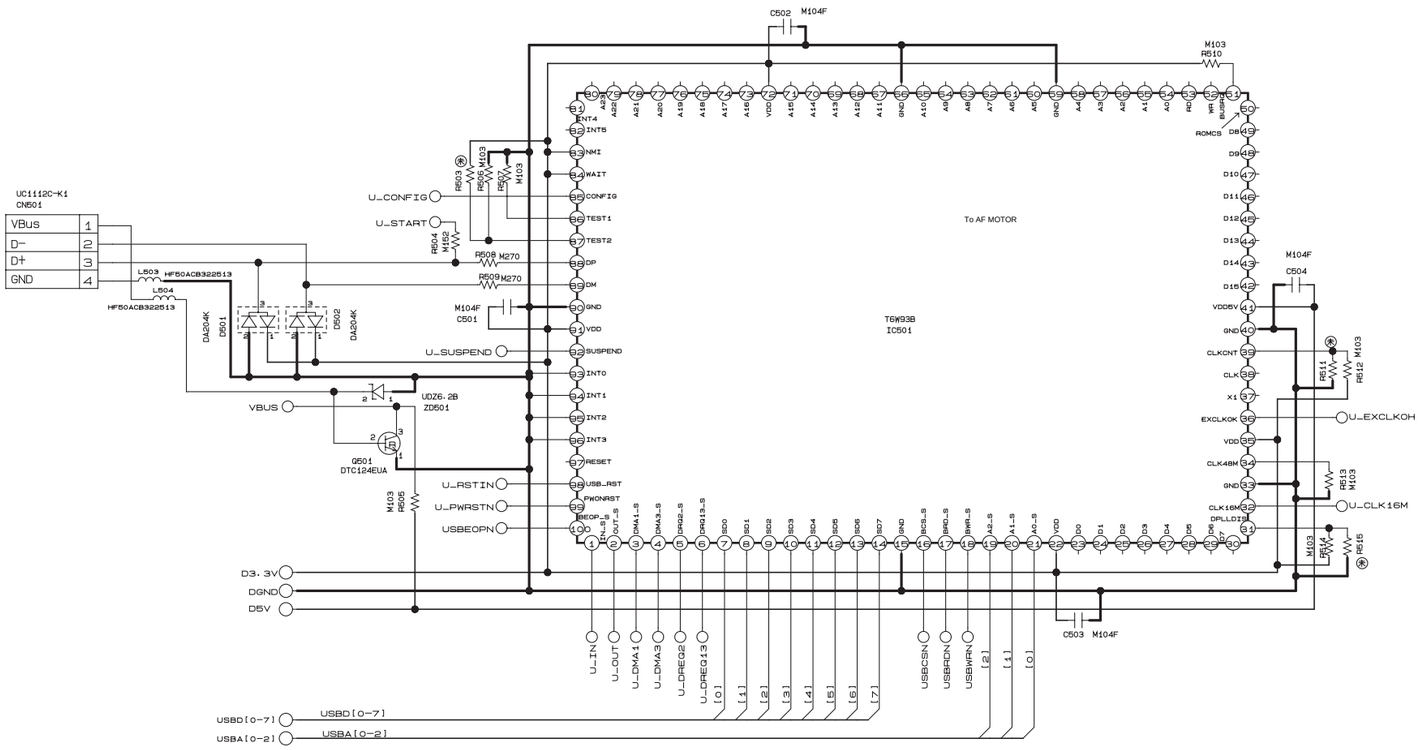
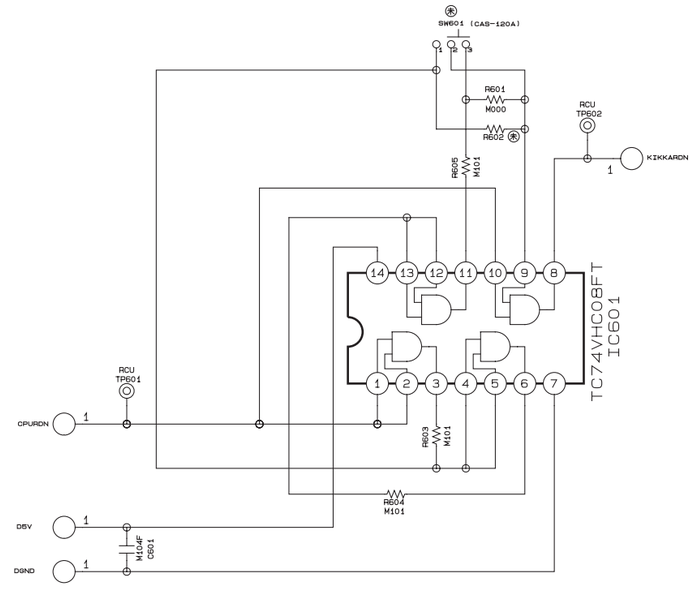
II-5. MAIN PCB (USB BLOCK)

USB BLOCK-1



USB BLOCK-2



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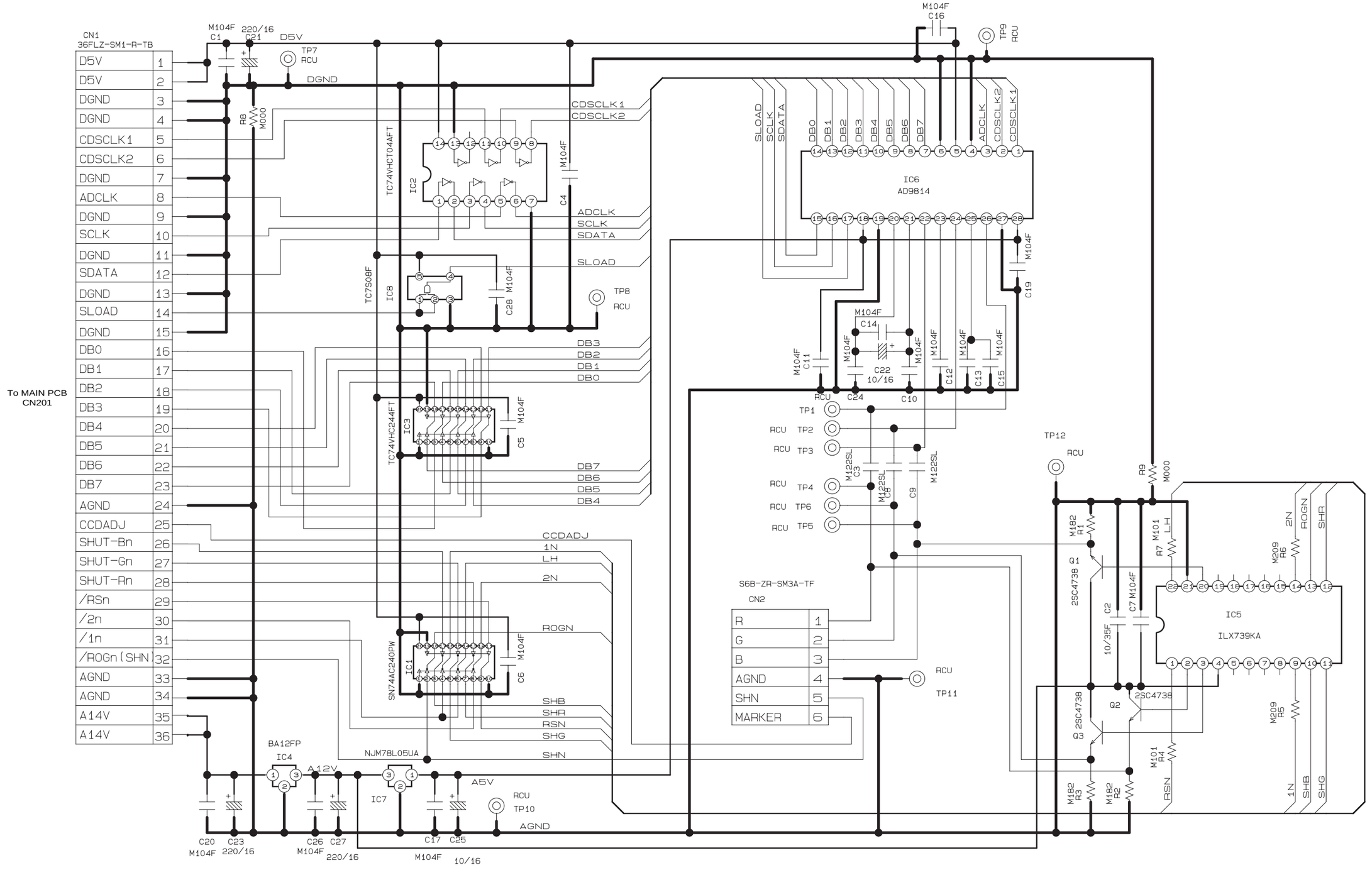
III. CCD PCB



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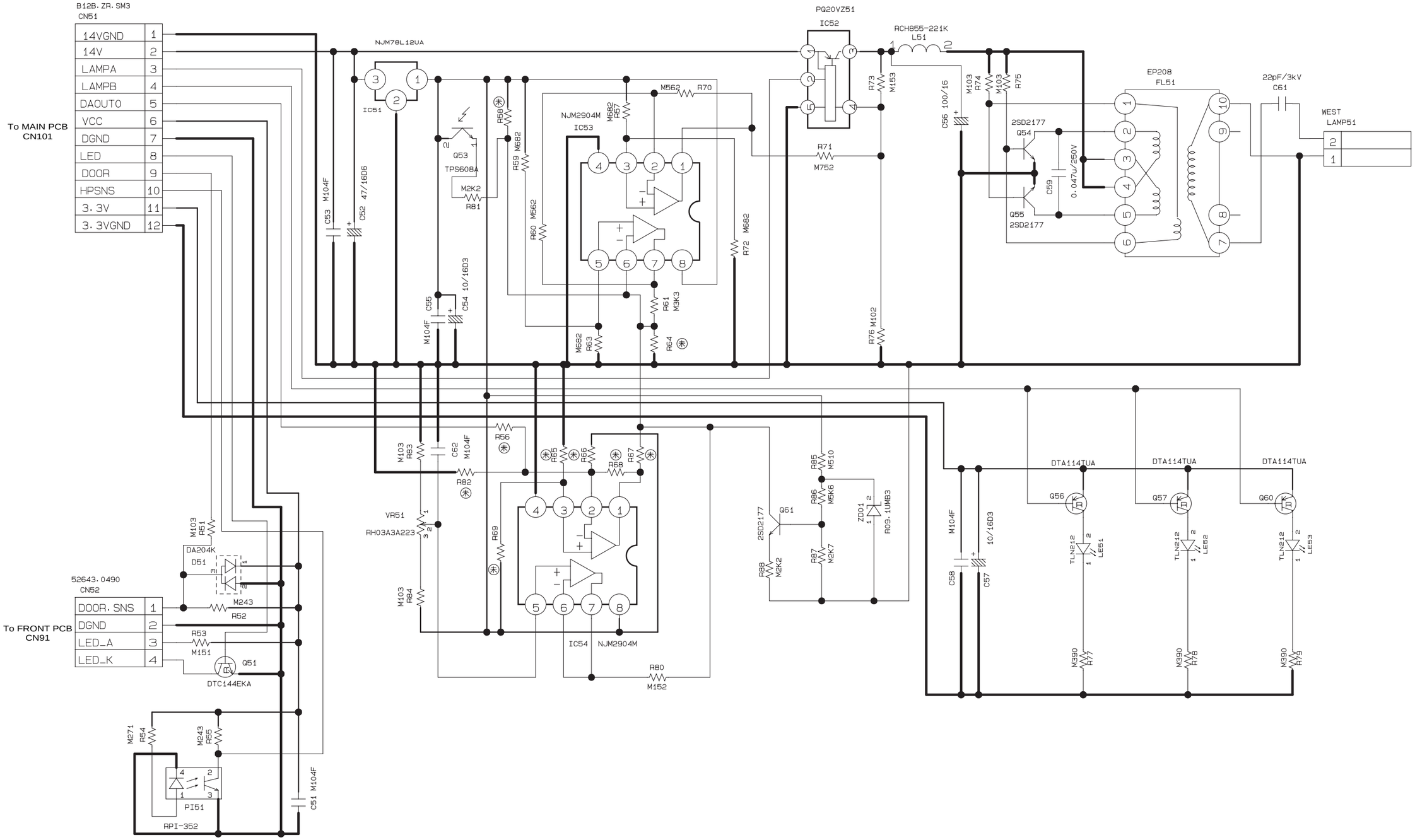
IV. LAMP PCB



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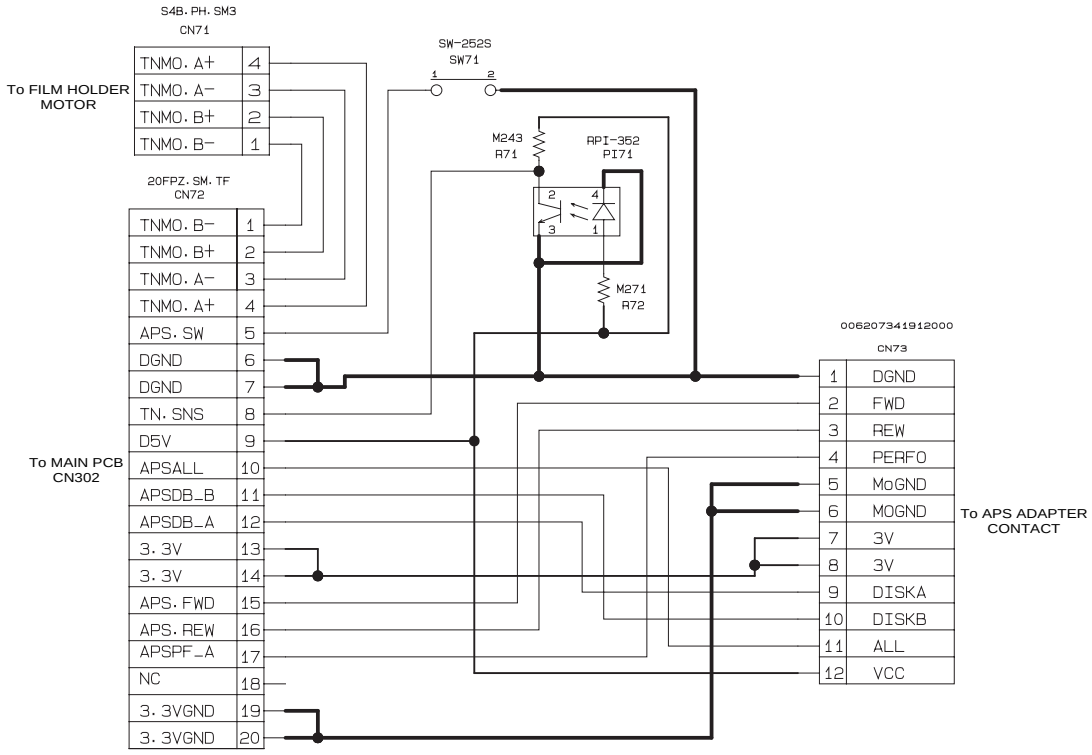
V. INTERCONNECTION PCB



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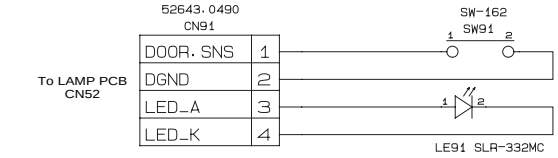
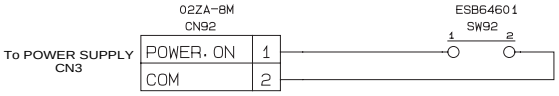
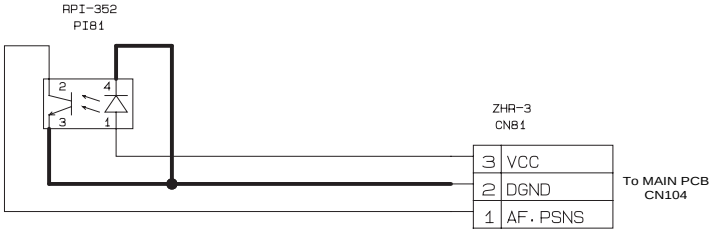
VI. FRONT/AF-PI PCB

FRONT PCB





AF-PI PCB



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